



# CANCER INCIDENCE DATA REVIEW 1985-2015

GENESEE COUNTY, MICHIGAN

Michigan Department of Health and Human Services  
Division of Environmental Health

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# Cancer Incidence Data Review, Genesee County, Michigan, 1985-2015

## Summary

This cancer data review was initiated as a result of citizen concerns within Genesee County, and not as a result of any documented cluster of cancer cases. This report provides cancer incidence rates for Genesee County compared to the State of Michigan and to two other urban counties that are sociodemographically similar to Genesee County (Saginaw and Calhoun Counties). The report also compares cancer incidence rates for each ZIP code of Genesee County to the county as a whole.

- Genesee County's total cancer incidence rate was higher than the State of Michigan for most years during 1985 to 2015. Rates of breast, colorectal, lung, and prostate cancer were not higher than the State of Michigan for most years during 1985 to 2015.
- Urban counties that are sociodemographically similar to Genesee County have rates of lung, female breast, and colorectal cancer that are not statistically different than Genesee County for most years during 1985 to 2015.
- Compared to the county, the frequency of cancers was higher than expected for some cancer types and in some ZIP codes and lower than expected in others.
- ZIP code 48505 stood out as having more statistical elevations in cancer incidence than expected compared to other ZIP codes (11 cancer types) but had cancer incidence that was statistically lower than expected for eight cancer sites.
- This data review cannot determine whether cancer rates are associated with environmental exposures. This data review is descriptive, only identifying if there is an excess of cancer incidence in Genesee County.

## Background

The Michigan Department of Health and Human Services' (MDHHS) Cancer Registry Program and Division of Environmental Health has conducted a review of cancer incidence data for diagnosis years 1985-2015, as collected by the Michigan Cancer Registry, for twenty ZIP codes located within or overlapping Genesee County, Michigan. We have prepared this report in response to requests from citizens arising from community concerns about cancer within Genesee County. According to the Centers for Disease Control and Prevention (CDC)<sup>1</sup>, a higher frequency of cancer than expected for a geographic area can be due to:

- Chance or coincidence
- Underestimating the expected number of cancer cases (e.g., not considering a risk factor within the population at risk)
- Higher frequency of known causes of cancer (e.g., smoking) and/or
- Higher frequency of unknown cause(s) of cancer, yet to be determined.

## Methods

A cancer case is defined as a person with newly diagnosed cancer where the cancer type is reported to be malignant and primary. The data source for cancer cases in this report is the Michigan Resident Cancer Incidence File managed by the Michigan Cancer Surveillance Program (MCSP) in the Division for Vital Records & Health Statistics (DVRHS), Michigan Department of Health & Human Services. As required by MCL 333.2619 and Administrative Rules R. 325.9050 *et seq.*, all newly diagnosed cases of invasive cancer in Michigan are routinely reported to the MCSP by reporting facilities such as hospitals and independent laboratories. This registry collects the patients' age, gender, race, cancer site and type, and residential address at the time of diagnosis. The registry does not record the cause of an individual's cancer nor does it collect sufficient information to determine the cause. Population data used in this report are prepared by DVRHS based on estimates released by the National Center for Health Statistics, which originate from the 2010 US Census population.<sup>2</sup>

### Part 1 – Comparing Cancer Incidence Rates for Genesee County to that of the State of Michigan and Urban Counties with Similar Sociodemographic Characteristics

Utilizing cancer incidence rates that are publicly available at the state and county level ([www.Michigan.gov/mdhhs/0,5885,7-339-73970\\_2944\\_5323---,00.html](http://www.Michigan.gov/mdhhs/0,5885,7-339-73970_2944_5323---,00.html)), we compared annual, age-adjusted cancer incidence rates for Genesee County and the State of Michigan between 1985 and 2015 for the following cancer types: lung, prostate, breast, colorectal, and all cancer types combined (total cancer). We also compared these cancer incidence rates for Genesee County to those of Saginaw County and Calhoun County. These counties were selected based on their status as an urban county and their similarity with Genesee County in the population distribution of sociodemographic factors, including percent African American, percent with at least a college education, percent living in poverty, median household income, and percent who own their home. Urban counties were defined by having an urbanized area of at least 50,000 people or by being adjacent to an urbanized area with a substantial commuting interchange with it. The source of information on sociodemographic factors and urban status was the U.S. Census Bureau.<sup>3</sup>

Cancer incidence rates are calculated as the number of new cancer cases during a given year in a geographic area divided by the population of the geographic area for that year.

Populations often differ in their distribution of age, which may in turn affect the overall rate of cancer cases in that population. For example, if one population has a larger number of elderly adults than another, it could demonstrate a higher cancer incidence rate simply due to its age structure. Therefore, when comparing cancer incidence rates between populations of different age distributions, it is important to account for those differences. In this report, age structure differences are accounted for

in calculating cancer incidence rates using direct standardization methodology to compute age-adjusted rates using the 2000 United States Standard Population.<sup>4</sup>

Age-adjusted cancer incidence rates for Genesee County, Saginaw County, Calhoun County and the State of Michigan are presented in line graphs to demonstrate time trends. To determine if Michigan or Genesee County have experienced an overall trend in cancer incidence over the 30-year period 1985-2015, the Spearman Correlation Coefficient and its accompanying statistical Rank Correlation Test were utilized. This test assesses whether there is a statistically significant monotonic relationship between 2 variables, in this case year and cancer incidence rate.

The Spearman Correlation Coefficient ( $\rho$ ,  $\rho$ ) ranges from  $-1.0$  to  $1.0$ . If the coefficient equals  $-1.0$ , it indicates a perfect negative correlation, where each year has a lower cancer incidence rate than the previous year. If the coefficient equals  $1.0$ , it indicates a perfect positive correlation, where each year has a higher cancer incidence rate than the previous year. As the correlation coefficient approaches  $0.0$ , from either direction, the relationship between the 2 variables weakens. For example, a correlation coefficient of  $0.90$  indicates a stronger positive relationship between 2 variables than a coefficient of  $0.50$ .

The p-value of the Rank Correlation test ranges from  $0.0$  to  $1.0$  and gives the probability of finding a significant overall monotonic trend in the cancer incidence rate data when, in reality, no trend exists. The standard used to assess the significance of a statistical test is  $p\text{-value} = 0.05$ . A p-value less than  $0.05$  indicates that there is less than a 5 percent chance of observing a trend, if in reality, rates are stable. In this case, the result is considered statistically significant. If the p-value is greater than or equal to  $0.05$ , chance cannot be excluded as a likely explanation for the observed trend, so the result is not considered statistically significant. From this, it follows that:

- If there is a statistically significant increase in cancer incidence rates over time, the Spearman Correlation Coefficient will be positive and the p-value for the test will be less than  $0.05$ .
- If there is a statistically significant decrease in cancer incidence rates over time, the Spearman Correlation Coefficient will be negative and the p-value for the test will be less than  $0.05$ .

The 95 percent confidence interval for each annual rate is also presented on the graphs. It represents the range we would expect the rate fall within 95 percent of the time. When the 95 percent confidence interval for the rate is wide, it indicates that the rate is imprecise; rates that are based on small numbers of cancer cases will have wide confidence intervals. Confidence intervals can also be used to test whether the county rate is statistically different than the rates for the comparison counties or for the State of Michigan as a whole. If the 95 percent confidence interval for comparison counties or the State of Michigan overlaps with the 95 percent confidence interval for the Genesee County rate, it

means that there is not a statistical difference between the county rate and the comparison counties or the state rate.

## Part 2 – Identifying the Occurrence of Excess Cancer Incidence in Genesee County ZIP Codes

For selected ZIP codes that intersect with Genesee County, we determined whether the cancer incidence that was observed during the time period 1985 through 2015 exceeded what would be expected based on the cancer incidence for Genesee County, for the following cancer types: all cancer types combined, brain and other central nervous system, female breast, colon and rectum, corpus uteri and uterus not other specified, esophagus, Hodgkin lymphoma, kidney and renal pelvis, larynx, leukemia, lip, oral cavity, and pharynx, liver and intrahepatic bile ducts, lung and bronchus, melanoma of the skin, multiple myeloma, non-Hodgkin lymphoma, ovarian, pancreas, prostate, stomach, testicular, thyroid gland, urinary bladder, and all other types not evaluated individually. For this, we calculated Standardized Incidence Ratios (SIRs). The SIR is calculated by dividing the number of cases of cancer that occurred among ZIP code residents (called observed cases) by the number of cases that would be expected if the ZIP code had the same cancer rate as Genesee County.

- When the **SIR equals 1.00**, it means that the number of cases of cancer observed in the ZIP code **is the same** as would be expected if the ZIP code has the same cancer rate as Genesee County.
- When the **SIR is less than 1.00**, it means that the ZIP code **has fewer** cancer cases than estimated from the county rate.
- When the **SIR is greater than 1.00**, it means that the ZIP code **has more** cancer cases observed than would be estimated from the county rate. For example, an SIR of 1.5 would mean that the number of cases in the ZIP code was 50 percent higher than would be expected if the ZIP code had the same cancer rate as the county.
- The degree to which the SIR is different than 1.0 (further away from 1.0 in either direction) indicates the strength of evidence for a difference between the expected and observed number of cases, i.e. that the ZIP code has higher or lower cancer incidence than the county. As the SIR approaches 1.0, the evidence for higher or lower cancer incidence in the ZIP code (versus the county) gets weaker. The SIR is interpreted using the following framework.<sup>5</sup>

SIR Value	Strength of Evidence that the ZIP code has Higher or Lower Cancer Incidence than the county
Less than 0.4	Strong evidence of decreased cancer incidence
0.4 to less than 0.7	Moderate evidence of decreased cancer incidence
0.7 to less than 0.9	Weak evidence of decreased cancer incidence
0.9 to less than 1.2	No evidence of a difference in cancer incidence

1.2 to less than 1.5	Weak evidence of increased cancer incidence
1.5 to less than 3.0	Moderate evidence of increased cancer incidence
3.0 or greater	Strong evidence of increased cancer incidence

Similar to the age-adjustment process explained in Part 1, SIR calculations for Part 2 account for both differences in the age structure and the sex distribution between the ZIP code and Genesee County populations using indirect standardization methodology. SIRs were tested for evidence of a statistical difference in cancer rates using a statistical test called the Exact Test (Byar approximation, Poisson Distribution) and by calculating 95 percent confidence intervals for each SIR. The 95 percent confidence interval represents the range in which we would expect the SIR to fall 95 percent of the time. When the 95 percent confidence interval is wide for an SIR, it indicates that the SIR is imprecise; SIRs that are based on small numbers of cancer cases will have wide confidence intervals. Confidence intervals can be used as another way to test whether the SIR shows evidence of a statistical difference in cancer rates. If the 95 percent confidence interval does not include the value 1.0 in its range, then the SIR is statistically different. It is important to note that when the number of cancer cases is small, such as for rare cancer types or in smaller ZIP codes, the report of only a few extra cancer cases can result in large SIRs, making interpretation of the confidence intervals particularly important. As long as the value 1.00 is contained within the SIR's 95 percent confidence interval, the SIR is within the range of expected values and is not evidence of a statistical difference in cancer incidence. Maps are included in this report for each cancer type to illustrate the distribution of statistically increased SIRs (Figures 6-29).

Cancer cases are allocated to a particular ZIP code based on the residential address of the person diagnosed with cancer at the time of their diagnosis. ZIP codes evaluated include: 48420, 48423, 48433, 48436, 48438, 48439, 48451, 48457, 48458, 48463, 48473, 48503, 48505, 48506, 48507, 48509, 48519, 48529, and the combined ZIP codes of 48504 and 48532. These two ZIP codes were combined due to how the boundaries of these ZIP codes have changed over the investigation period (1985-2015). ZIP code 48502 was not included in the analysis since this downtown ZIP code has a small resident population of which a sizeable portion is incarcerated in the Genesee County Jail, located within this ZIP code. The address at time of cancer diagnosis for county jail inmates was recorded as the address of the Genesee County Jail and does not represent the actual residential address of the person diagnosed. ZIP code 48437 was not included in analysis due to its very small population size, which makes estimates of the SIR less precise. According to the US Census Bureau, this ZIP code had 906 people in 1994, 373 people in 2000, and 581 people in 2010. ZIP codes 48411, 48551, 48553, and 48554 were also not included because they are non-residential ZIP codes.



## Limitations

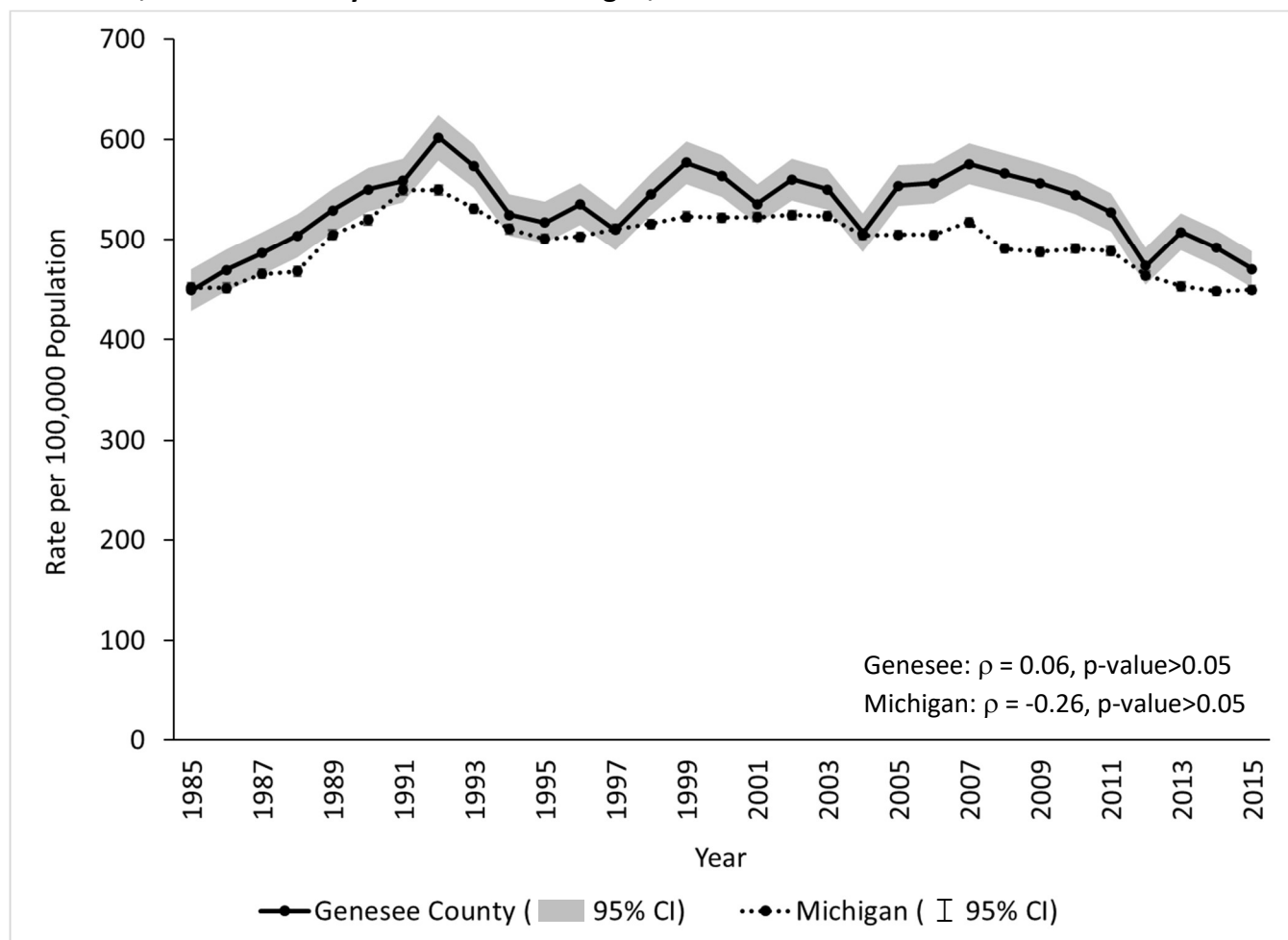
- Results of this investigation are based on surveillance data and not an epidemiologic research study of the relationship between any risk factors and cancer incidence. Therefore, these results cannot indicate whether any cancer occurrence is related to or caused by environmental contaminant exposures. Michigan Central Cancer Registry records do not include the data necessary to make such an evaluation. If a statistical increase (or decrease) is observed among the results of these analyses, it does not necessarily mean that the difference is due to an environmental exposure.
- This review cannot determine which individuals (with or without cancer) residing within the geographic area have been exposed to any environmental contaminant.
- The latency period is the time that passes between being exposed to something that can cause cancer (such as an environmental contaminant) and having symptoms or being diagnosed. Latency periods vary by cancer type. Cancer observed during a specific period could be related to an exposure that occurred a long time ago.
- Migration of people into and out of an area of analysis limits the interpretation of this data. The Michigan Cancer Surveillance Program records a person's address at time of cancer diagnosis, which may not reflect where they spent the majority of their life or the period of time when exposure to a cancer-causing agent occurred. For example, cancer cases included in the analysis of the investigation period could be related to exposures they had when they lived in another state.
- Multiple cancer data years have been combined due to the small number of cancer cases for the selected geographic area.

## Results

### Part 1 — Comparing Cancer Incidence Rates for Genesee County to that of the State of Michigan and Urban Counties with Similar Sociodemographic Characteristics

Figures 1-5 provide the annual trend in cancer incidence rates (1985 – 2015) for the most common cancers in Genesee County and the State of Michigan. Figures 6-10 provide the annual trend in cancer incidence rates (1985 – 2015) for the most common cancers in Genesee County and the two comparison counties, Saginaw County and Calhoun County.

**Figure 1. Age-Adjusted<sup>1</sup> Cancer Incidence Rate (per 100,000 Population) by Year for All Cancer Types<sup>2</sup> Combined, Genesee County and State of Michigan, 1985-2015**

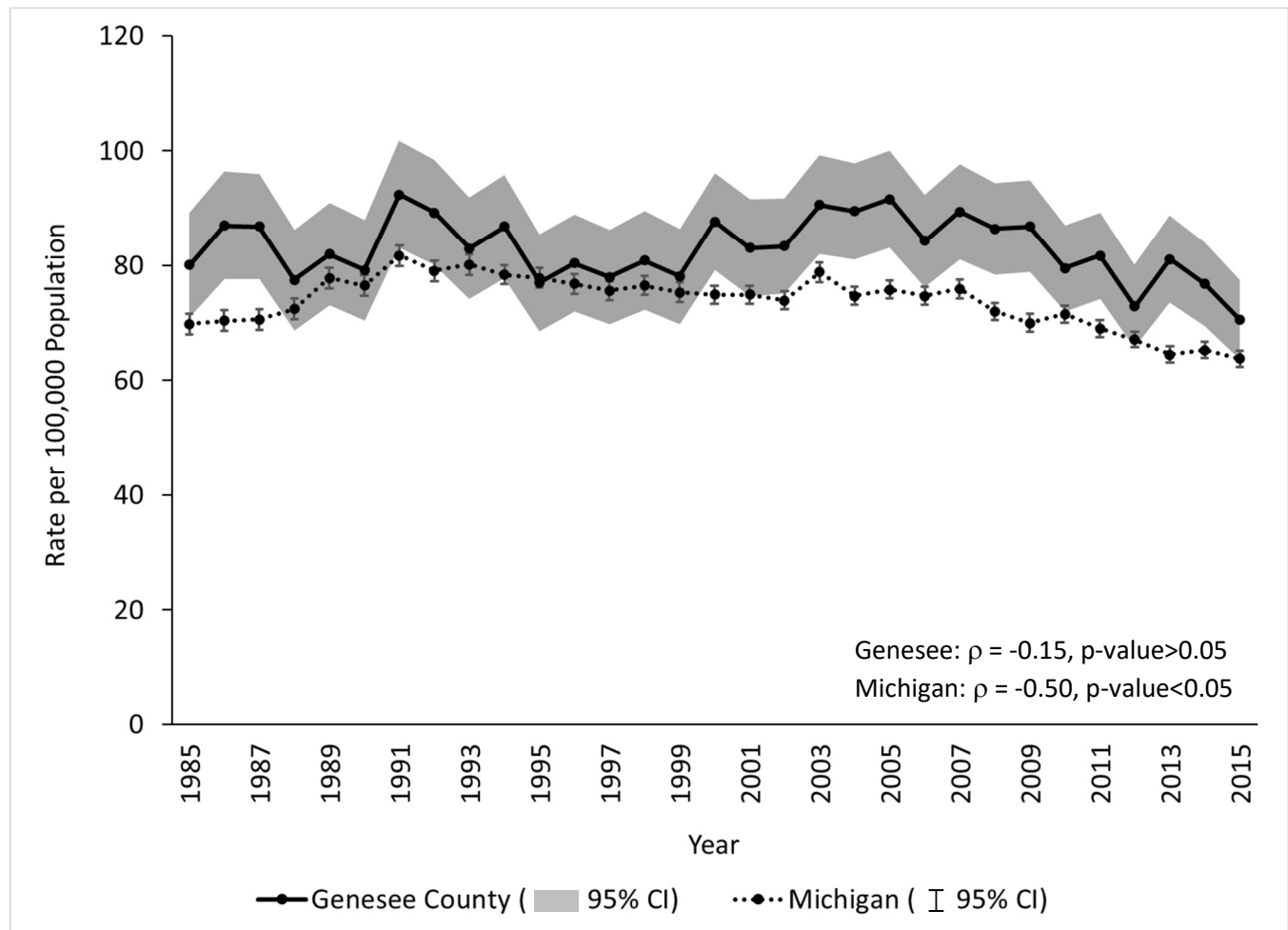


<sup>1</sup>**Age-Adjusted Rates** are calculated for the total population by the direct method, using the age distribution of the 2000 United States Standard Population.

<sup>2</sup>**Source of Michigan Cancer Cases:** Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2019. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

- Genesee County's total cancer incidence rate was statistically higher than the State of Michigan for most years during 1985 to 2015 (19 out of 31 years).
- Total cancer incidence rates did not demonstrate a statistically increasing or decreasing trend over this time period for either Genesee County or State of Michigan ( $p > 0.05$  for each).

**Figure 2. Age-Adjusted<sup>1</sup> Cancer Incidence Rate (per 100,000 Population) by Year for Lung Cancer<sup>2</sup>, Genesee County and State of Michigan, 1985 – 2015**

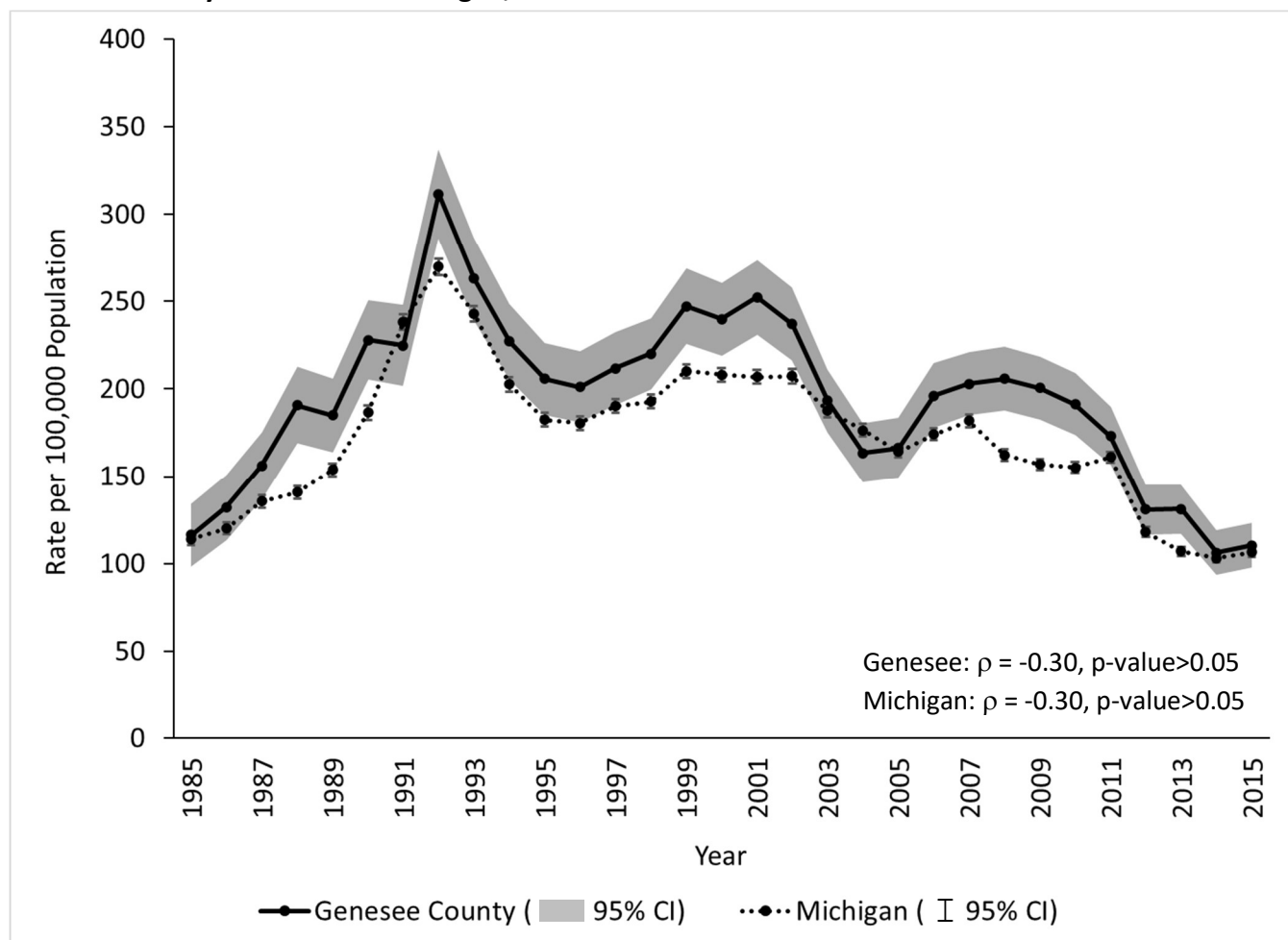


<sup>1</sup>**Age-Adjusted Rates** are calculated for the total population by the direct method, using the age distribution of the 2000 United States Standard Population.

<sup>2</sup>**Source of Michigan Cancer Cases:** Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2019. Lung cancer cases were defined by new malignant cancer diagnoses where lung was the primary site. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

- Genesee County's lung cancer incidence rate was not statistically different than the State of Michigan for most years during 1985 to 2015 (19 out of 31 years).
- Lung cancer incidence rates did not demonstrate a statistically increasing or decreasing trend over this time period for Genesee County ( $p > 0.05$ ); lung cancer rates for the State of Michigan demonstrate an overall decline over this time period ( $p < 0.05$ ).

**Figure 3. Age-Adjusted<sup>1</sup> Cancer Incidence Rate (per 100,000 Population) by Year for Prostate Cancer<sup>2</sup>, Genesee County and State of Michigan, 1985 – 2015**

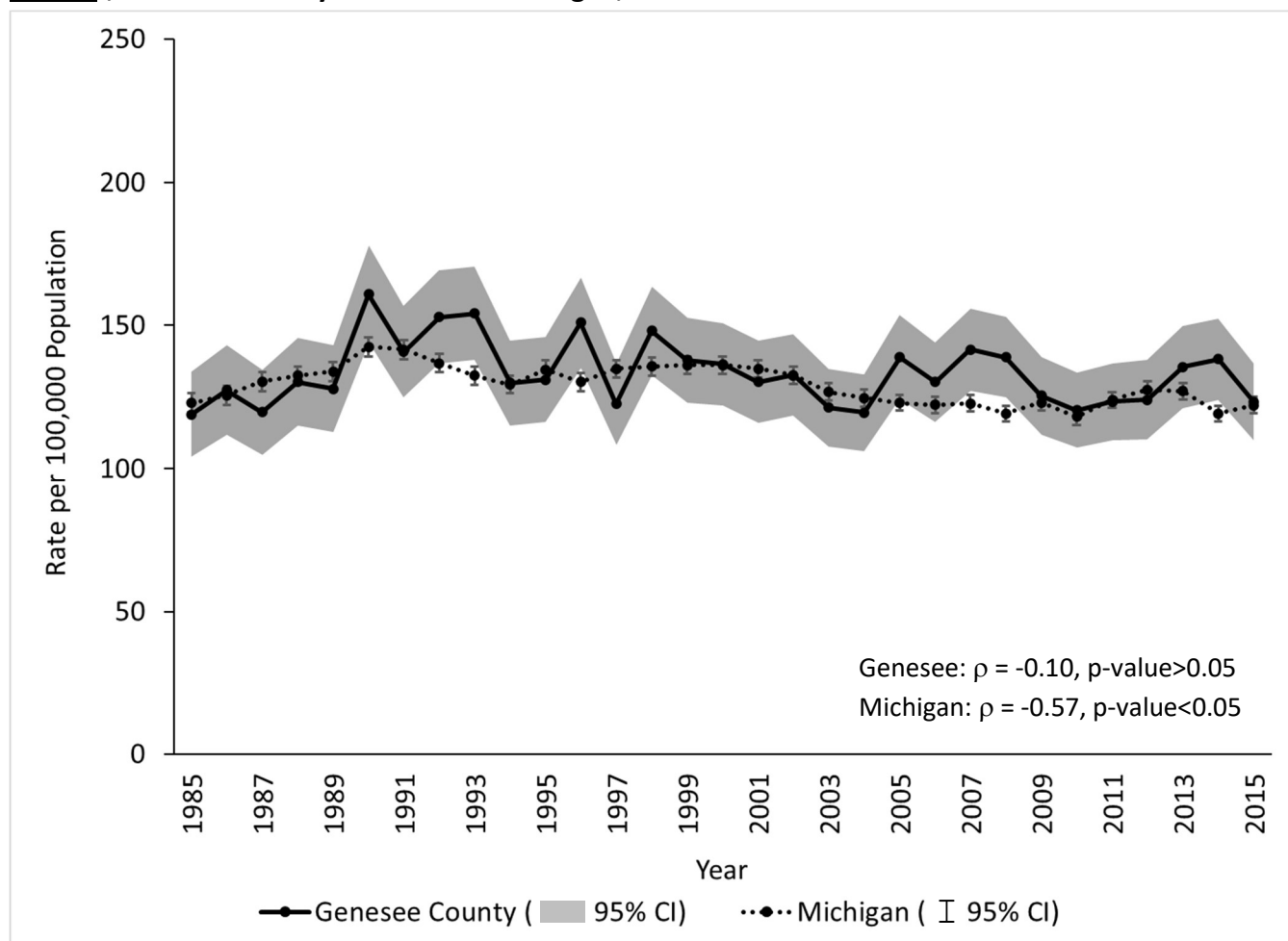


<sup>1</sup>**Age-Adjusted Rates** are calculated for the total population by the direct method, using the age distribution of the 2000 United States Standard Population.

<sup>2</sup>**Source of Michigan Cancer Cases:** Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2019. Prostate cancer cases were defined by new malignant cancer diagnoses where prostate was the primary site. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

- Genesee County's prostate cancer incidence rate was statistically higher than the State of Michigan for almost half of the years during 1985 to 2015 (14 out of 31 years).
- Prostate cancer incidence rates did not demonstrate a statistically increasing or decreasing trend over this time period for either Genesee County or State of Michigan ( $p > 0.05$  for each).

**Figure 4. Age-Adjusted<sup>1</sup> Cancer Incidence Rate (per 100,000 Population) by Year for Female Breast Cancer<sup>2</sup>, Genesee County and State of Michigan, 1985 – 2015**

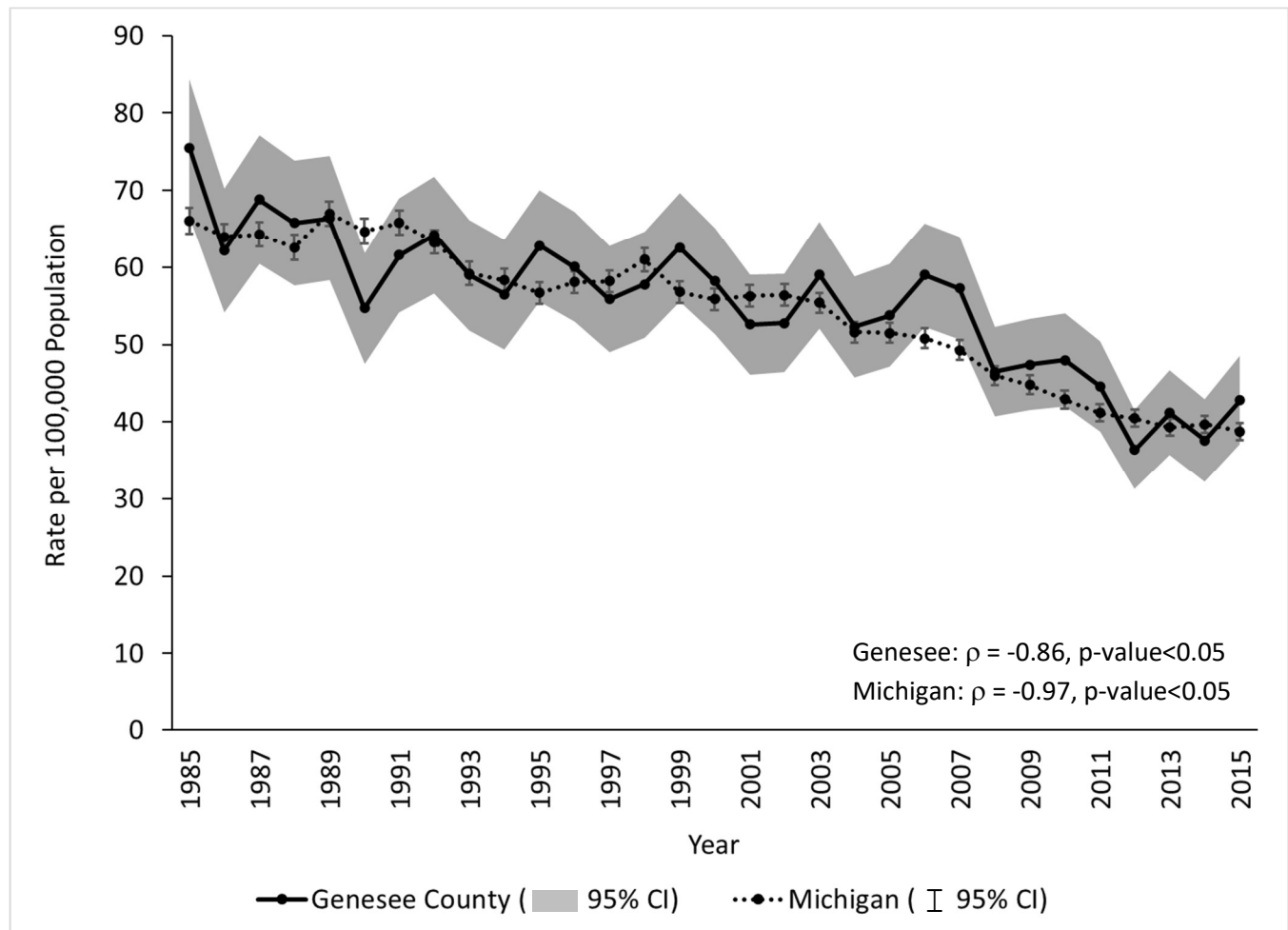


<sup>1</sup>**Age-Adjusted Rates** are calculated for the female population by the direct method, using the age distribution of the 2000 United States Standard Population.

<sup>2</sup>**Source of Michigan Cancer Cases:** Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2019. Breast cancer cases were defined by new malignant cancer diagnoses where breast was the primary site. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

- Genesee County's female breast cancer incidence rate was not statistically different than the State of Michigan for most years during 1985 to 2015 (26 out of 31 years).
- Female breast cancer incidence rates did not demonstrate a statistically increasing or decreasing trend over this time period for Genesee County ( $p > 0.05$ ); female breast cancer rates for the State of Michigan demonstrate an overall decline over this time period ( $p < 0.05$ ).

**Figure 5. Age-Adjusted<sup>1</sup> Cancer Incidence Rate (per 100,000 Population) by Year for Colorectal Cancer<sup>2</sup>, Genesee County and State of Michigan, 1985 – 2015**

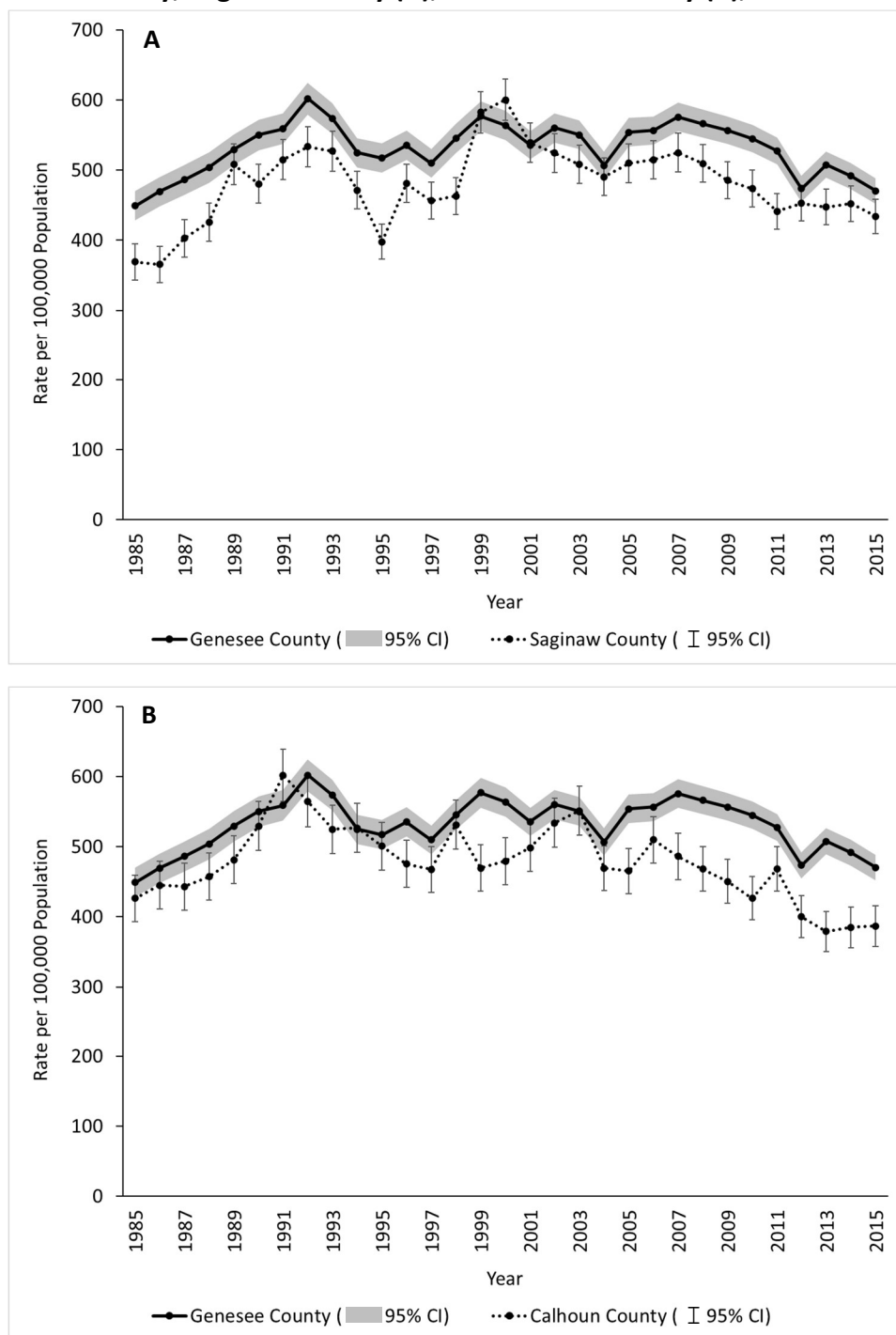


<sup>1</sup>**Age-Adjusted Rates** are calculated for the total population by the direct method, using the age distribution of the 2000 United States Standard Population.

<sup>2</sup>**Source of Michigan Cancer Cases:** Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2019. Colorectal cancer cases were defined by new malignant cancer diagnoses where the colon or the rectum was the primary site. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

- Genesee County's colorectal cancer incidence rate was not statistically different than the State of Michigan for most years during 1985 to 2015 (28 out of 31 years).
- Colorectal cancer incidence rates demonstrate a statistically decreasing trend over this time period for both Genesee County and State of Michigan ( $p < 0.05$  for each).

**Figure 6. Age-Adjusted<sup>1</sup> Cancer Incidence Rate (per 100,000 Population) by Year for All Cancer Types<sup>2</sup> Combined, Genesee County, Saginaw County (A), and Calhoun County (B), 1985-2015**



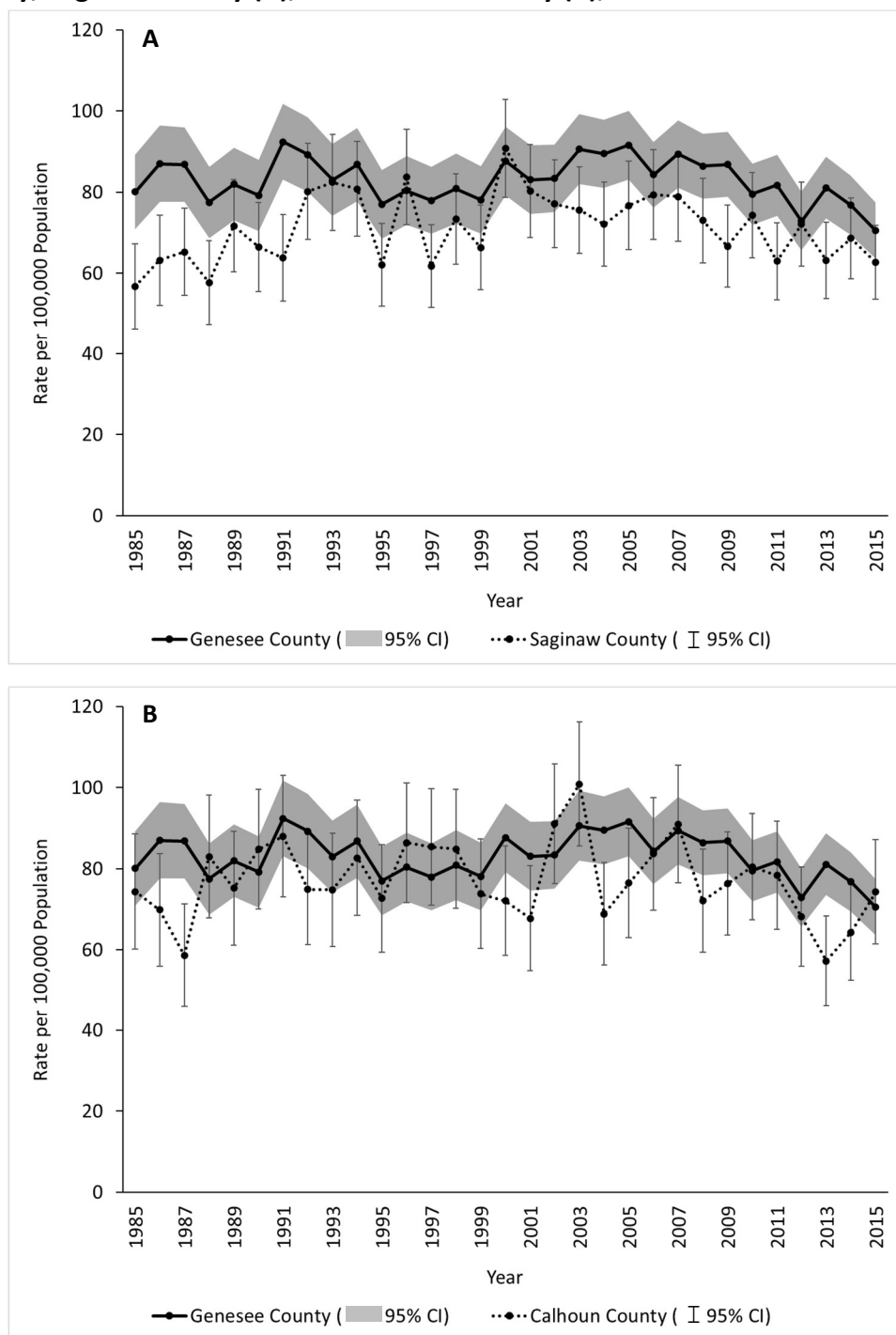
<sup>1</sup>**Age-Adjusted Rates** are calculated for the total population by the direct method, using the age distribution of the 2000 United States Standard Population.

<sup>2</sup>**Source of Michigan Cancer Cases:** Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2019. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

- Genesee County's total cancer incidence rate was statistically higher than Saginaw County for about half of the years during 1985 to 2015 (17 out of 31 years).
- Genesee County's total cancer incidence rate was not statistically different than Calhoun County for most years during 1985 to 2015 (18 out of 31 years).



**Figure 7. Age-Adjusted<sup>1</sup> Cancer Incidence Rate (per 100,000 Population) by Year for Lung Cancer<sup>2</sup>, Genesee County, Saginaw County (A), and Calhoun County (B), 1985-2015**

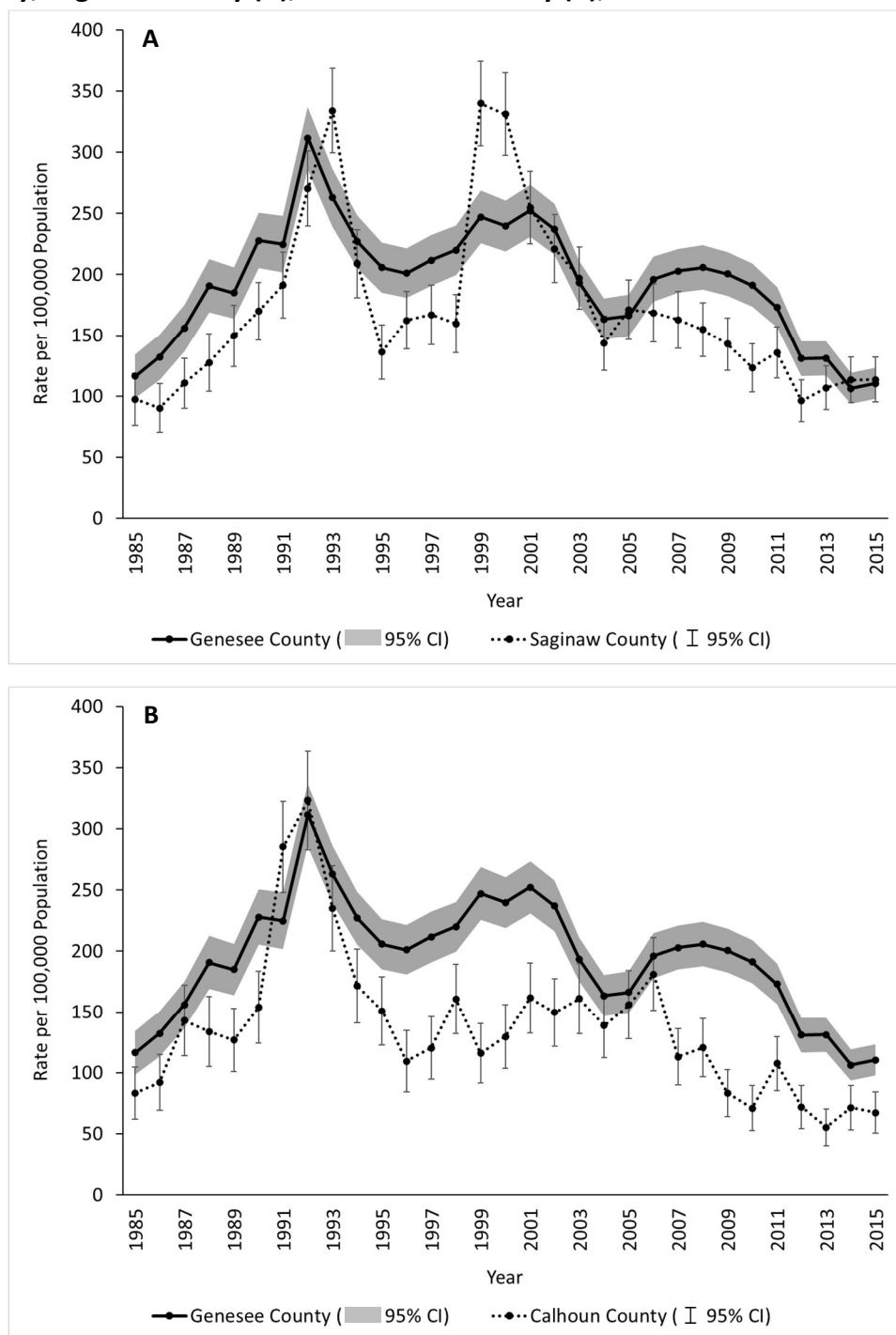


<sup>1</sup>**Age-Adjusted Rates** are calculated for the total population by the direct method, using the age distribution of the 2000 United States Standard Population.

<sup>2</sup>**Source of Michigan Cancer Cases:** Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2019. Lung cancer cases were defined by new malignant cancer diagnoses where lung was the primary site. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

- Genesee County's lung cancer incidence rate was not statistically different than Saginaw County for most years during 1985 to 2015 (23 out of 31 years).
- Genesee County's lung cancer incidence rate was not statistically different than Calhoun County for most years during 1985 to 2015 (29 out of 31 years).

**Figure 8. Age-Adjusted<sup>1</sup> Cancer Incidence Rate (per 100,000 Population) by Year for Prostate Cancer<sup>2</sup>, Genesee County, Saginaw County (A), and Calhoun County (B), 1985-2015**

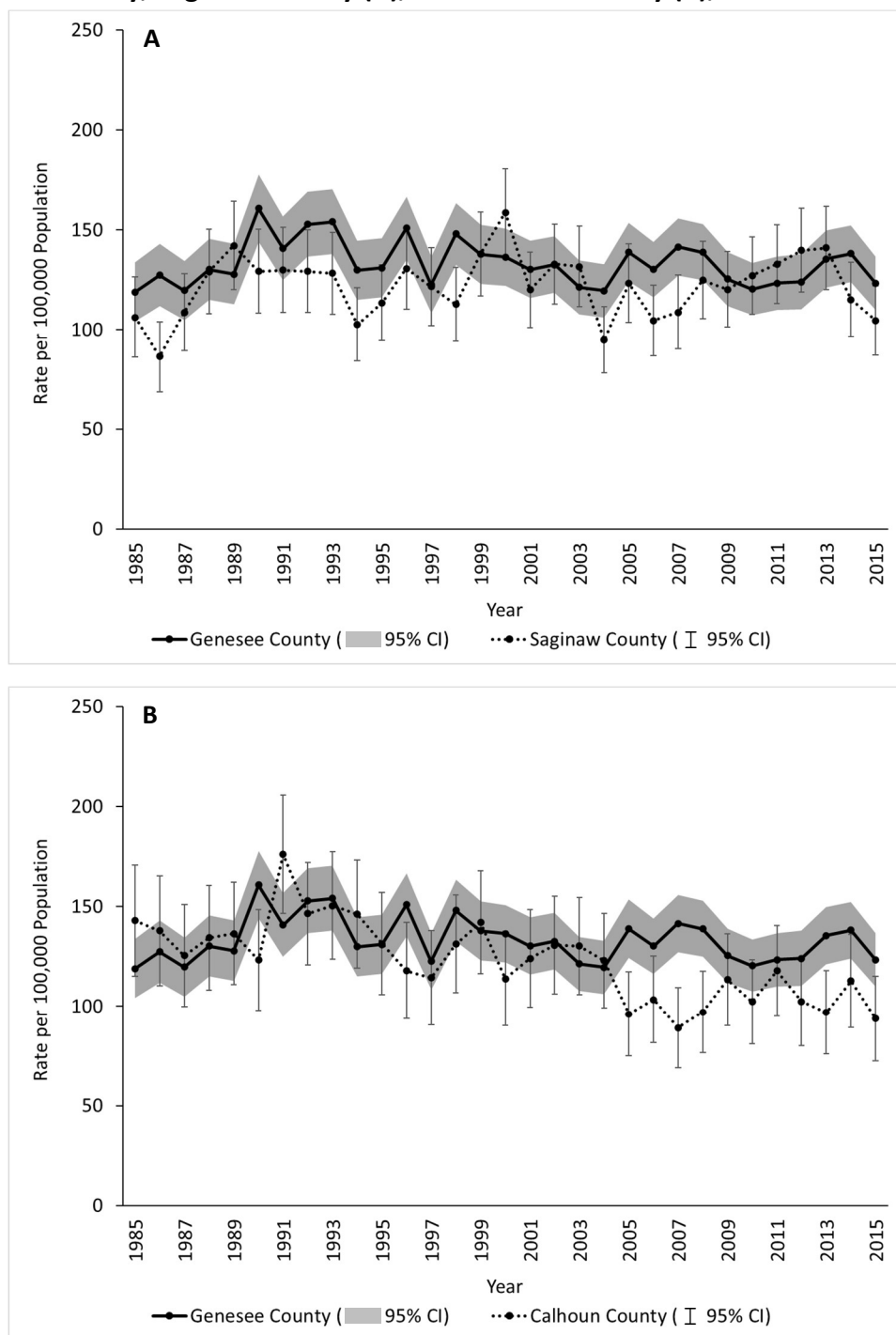


<sup>1</sup>**Age-Adjusted Rates** are calculated for the total population by the direct method, using the age distribution of the 2000 United States Standard Population.

<sup>2</sup>**Source of Michigan Cancer Cases:** Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2019. Prostate cancer cases were defined by new malignant cancer diagnoses where prostate was the primary site. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

- Genesee County's prostate cancer incidence rate was not statistically different than Saginaw County for most years during 1985 to 2015 (18 out of 31 years).
- Genesee County's prostate cancer incidence rate was statistically higher than Calhoun County for most years during 1985 to 2015 (21 out of 31 years).

**Figure 9. Age-Adjusted<sup>1</sup> Cancer Incidence Rate (per 100,000 Population) by Year for Female Breast Cancer<sup>2</sup>, Genesee County, Saginaw County (A), and Calhoun County (B), 1985-2015**

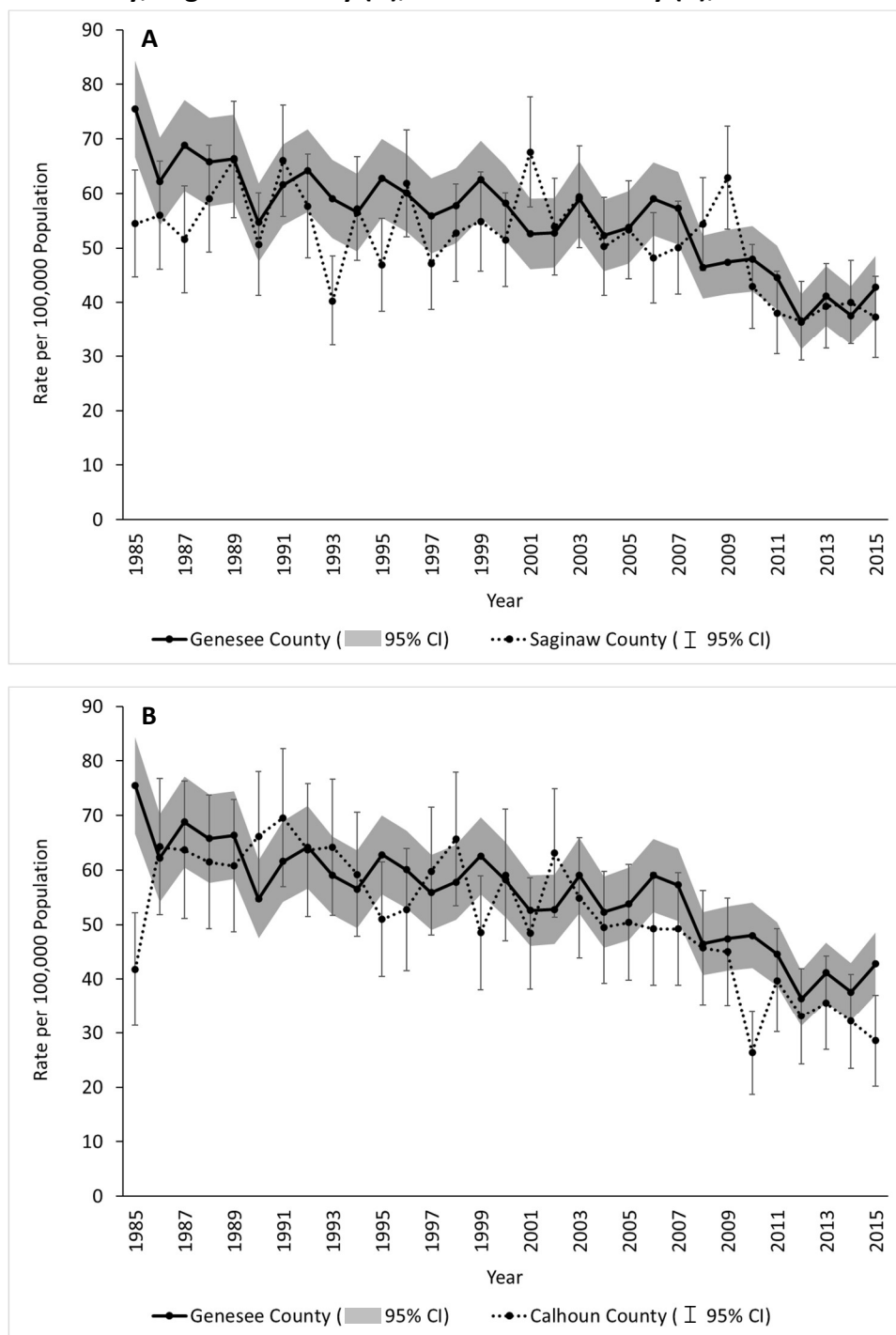


<sup>1</sup>**Age-Adjusted Rates** are calculated for the female population by the direct method, using the age distribution of the 2000 United States Standard Population.

<sup>2</sup>**Source of Michigan Cancer Cases:** Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2019. Breast cancer cases were defined by new malignant cancer diagnoses where breast was the primary site. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

- Genesee County's female breast cancer incidence rate was not statistically different than Saginaw County for most years during 1985 to 2015 (29 out of 31 years).
- Genesee County's female breast cancer incidence rate was not statistically different than Calhoun County for most years during 1985 to 2015 (27 out of 31 years).

**Figure 10. Age-Adjusted<sup>1</sup> Cancer Incidence Rate (per 100,000 Population) by Year for Colorectal Cancer<sup>2</sup>, Genesee County, Saginaw County (A), and Calhoun County (B), 1985-2015**



<sup>1</sup>**Age-Adjusted Rates** are calculated for the total population by the direct method, using the age distribution of the 2000 United States Standard Population.

<sup>2</sup>**Source of Michigan Cancer Cases:** Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2019. Colorectal cancer cases were defined by new malignant cancer diagnoses where the colon or the rectum was the primary site. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

- Genesee County's colorectal cancer incidence rate was not statistically different than Saginaw County for most years during 1985 to 2015 (27 out of 31 years).
- Genesee County's colorectal cancer incidence rate was not statistically different than Calhoun County for most years during 1985 to 2015 (28 out of 31 years).



## Part 2 – Identifying the Occurrence of Excess Cancer Incidence in Genesee County ZIP Codes

### All Cancer Types Combined (*Table 1, Figure 11*)

For all cancer types combined in Genesee County, six ZIP codes (48433, 48438, 48457, 48503, 48529, and 48504 and 48532 combined) had fewer cases than expected. Two ZIP codes (48505 and 48509) had a higher number of cases than expected. ZIP code 48505 had 8 percent more cases than expected (95% CI: 5%-10%) while 48509 had 7 percent more cases than expected (95% CI: 3%-11%).

**Table 1. Standardized Incidence Ratio (SIR)<sup>1</sup> for Total Cancer Cases (All Cancer Types Combined) by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95% CI
48420	3,421	3,511.28	0.97	0.95 - 1.00
48423	4,637	4,681.39	0.99	0.97 - 1.01
48433	4,389	4,637.98	0.95	0.92 - 0.97
48436	461	466.03	0.99	0.91 - 1.07
48438	753	829.33	0.91	0.85 - 0.96
48439	6,082	6,110.48	1.00	0.97 - 1.02
48451	1,761	1,839.02	0.96	0.92 - 1.00
48457	1,162	1,252.80	0.93	0.88 - 0.97
48458	3,755	3,719.49	1.01	0.98 - 1.04
48463	694	738.19	0.94	0.88 - 1.00
48473	3,286	3,366.63	0.98	0.95 - 1.00
48503	4,784	5,000.46	0.96	0.93 - 0.98
48505	5,299	4,925.40	1.08	1.05 - 1.10
48506	4,765	4,855.13	0.98	0.96 - 1.01
48507	5,629	5,717.19	0.98	0.96 - 1.01
48509	1,885	1,759.13	1.07	1.03 - 1.11
48519	1,129	1,173.45	0.96	0.92 - 1.01
48529	1,427	1,500.13	0.95	0.91 - 0.99
48504 + 48532	8,203	8,590.58	0.95	0.94 - 0.97

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value of 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

### Brain and Other Central Nervous System (Table 2, Figure 12)

Three ZIP codes (48438, 48505, and 48504 and 48532 combined) indicated lower than expected brain and other central nervous system (CNS) cancers. None of the ZIP codes analyzed had a higher than expected number of brain and other CNS cancers.

**Table 2. Standardized Incidence Ratio (SIR)<sup>1</sup> for Brain or Other Central Nervous System Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	54	49.52	1.09	0.86 - 1.37
48423	66	65.80	1.00	0.81 - 1.23
48433	68	60.42	1.13	0.91 - 1.38
48436	9	7.19	1.25	0.65 - 2.19
48438	6	12.51	0.48	0.21 - 0.95
48439	85	85.67	0.99	0.82 - 1.19
48451	31	26.76	1.16	0.84 - 1.56
48457	17	17.95	0.95	0.60 - 1.42
48458	51	52.60	0.97	0.76 - 1.22
48463	11	10.46	1.05	0.59 - 1.74
48473	51	45.84	1.11	0.87 - 1.40
48503	64	68.04	0.94	0.76 - 1.16
48505	57	73.86	0.77	0.61 - 0.96
48506	75	70.96	1.06	0.86 - 1.28
48507	66	78.33	0.84	0.68 - 1.03
48509	23	23.17	0.99	0.68 - 1.41
48519	16	15.81	1.01	0.63 - 1.54
48529	21	22.62	0.93	0.62 - 1.34
48504 + 48532	94	122.29	0.77	0.64 - 0.91

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services. Brain and other central nervous system cancer cases were defined by new malignant cancer diagnoses where the primary site was the brain or other central nervous system.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value of 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

### Female Breast (Table 3, Figure 13)

Four ZIP code areas (48505, 48506, 48529, and 48504 and 48532 combined) showed lower than expected female breast cancer cases. The ZIP code of 48439 in Genesee County showed a statistical increase in breast cancer cases. ZIP code 48439 had 11 percent more cases than expected (95% CI 5%-17%).

**Table 3. Standardized Incidence Ratios (SIR)<sup>1</sup> for Breast Cancer in Females by ZIP Code of Residence, Adjusted for Age, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	456	476.52	0.96	0.88 - 1.03
48423	645	659.20	0.98	0.92 - 1.04
48433	660	628.66	1.05	0.98 - 1.12
48436	63	62.76	1.00	0.81 - 1.24
48438	124	112.14	1.11	0.95 - 1.28
48439	933	841.98	1.11	1.05 - 1.17
48451	255	250.21	1.02	0.92 - 1.13
48457	156	173.24	0.90	0.79 - 1.03
48458	484	513.03	0.94	0.87 - 1.02
48463	98	97.91	1.00	0.84 - 1.18
48473	485	457.00	1.06	0.98 - 1.14
48503	688	707.19	0.97	0.91 - 1.04
48505	629	699.58	0.90	0.84 - 0.96
48506	591	681.94	0.87	0.81 - 0.93
48507	774	809.99	0.96	0.90 - 1.01
48509	235	233.46	1.01	0.90 - 1.12
48519	156	167.13	0.93	0.81 - 1.07
48529	179	209.94	0.85	0.75 - 0.97
48504 + 48532	1,100	1,221.04	0.90	0.86 - 0.95

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Female breast cancer cases were defined by new malignant cancer diagnoses where the primary site was the breast in females.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value of 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

### Colon and Rectum (Table 4, Figure 14)

For colon and rectum cancers, three ZIP code areas (48433, 48473, and 48507) had lower than expected cases and two ZIP codes had higher than expected cases. Statistical increases in colon and rectal cancer cases were shown in ZIP codes 48505 and 48506 with increases of 19 percent (95% CI 11% – 28%) and 8 percent (95% CI 0% – 16%), respectively.

**Table 4: Standardized Incidence Ratios (SIR)<sup>1</sup> for Colon and Rectum Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	338	349.15	0.97	0.88 - 1.06
48423	477	466.18	1.02	0.95 - 1.10
48433	403	471.42	0.85	0.79 - 0.93
48436	39	43.95	0.89	0.67 - 1.16
48438	65	78.84	0.82	0.66 - 1.01
48439	600	605.86	0.99	0.92 - 1.06
48451	170	179.74	0.95	0.83 - 1.07
48457	118	124.91	0.94	0.81 - 1.10
48458	396	366.13	1.08	0.99 - 1.18
48463	64	71.13	0.90	0.72 - 1.11
48473	295	332.52	0.89	0.80 - 0.98
48503	524	514.48	1.02	0.95 - 1.09
48505	573	480.58	1.19	1.11 - 1.28
48506	521	482.04	1.08	1.00 - 1.16
48507	523	581.79	0.90	0.84 - 0.97
48509	181	176.17	1.03	0.91 - 1.16
48519	108	119.60	0.90	0.76 - 1.06
48529	127	146.88	0.86	0.74 - 1.00
48504 + 48532	865	880.15	0.98	0.93 - 1.04

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services. Colon and rectum cancer cases were defined by new malignant cancer diagnoses where the primary site was the colon or rectum.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value of 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

### Corpus Uteri & Uterus Not Other Specified (NOS) (Table 5, Figure 15)

Two ZIP codes (48420 and 48457) had lower than expected numbers of cancer of the corpus uteri (the main body of the uterus) and uterus not other specified. One ZIP code (48509) had higher than expected cases. This ZIP code showed an increase of 32 percent (95% CI 8% – 60%) more cases than expected.

**Table 5. Standardized Incidence Ratios (SIR)<sup>1</sup> for Cancers of the Corpus Uteri and Uterus Not Other Specified in Females by ZIP Code of Residence, Adjusted for Age, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	94	112.52	0.84	0.70 - 0.99
48423	162	156.07	1.04	0.91 - 1.18
48433	146	150.23	0.97	0.84 - 1.11
48436	18	14.48	1.24	0.80 - 1.84
48438	22	25.96	0.85	0.57 - 1.21
48439	190	198.28	0.96	0.85 - 1.08
48451	52	58.56	0.89	0.70 - 1.12
48457	30	40.91	0.73	0.53 - 0.99
48458	107	121.73	0.88	0.74 - 1.03
48463	25	23.10	1.08	0.75 - 1.51
48473	108	108.19	1.00	0.85 - 1.17
48503	154	169.16	0.91	0.79 - 1.04
48505	145	165.11	0.88	0.76 - 1.01
48506	144	161.16	0.89	0.77 - 1.03
48507	211	193.16	1.09	0.97 - 1.22
48509	74	56.01	1.32	1.08 - 1.60
48519	44	39.87	1.10	0.84 - 1.42
48529	55	49.16	1.12	0.88 - 1.40
48504 + 48532	294	288.87	1.02	0.92 - 1.12

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Corpus uteri & uterus not other specified cancer cases were defined by new malignant cancer diagnoses where the primary site was the corpus uteri or uterus not other specified in females.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value of 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

### Esophagus (Table 6, Figure 16)

For esophageal cancer, three ZIP code areas (48433, 48438, and 48439) indicated lower than expected cases while one ZIP code (48505) had higher than expected cases. ZIP code 48505 had 61 percent higher than expected cases of esophageal cancer (95% CI 36% – 90%).

**Table 6. Standardized Incidence Ratios (SIR)<sup>1</sup> of Esophagus Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	45	46.08	0.98	0.75 - 1.25
48423	59	60.09	0.98	0.78 - 1.22
48433	45	60.66	0.74	0.57 - 0.95
48436	^	^	0.80	0.31 - 1.68
48438	^	^	0.18	0.03 - 0.57
48439	55	79.64	0.69	0.54 - 0.86
48451	21	24.25	0.87	0.58 - 1.25
48457	11	16.33	0.67	0.38 - 1.11
48458	49	47.87	1.02	0.80 - 1.30
48463	11	9.95	1.11	0.62 - 1.83
48473	51	44.29	1.15	0.90 - 1.45
48503	57	63.13	0.90	0.72 - 1.13
48505	100	62.00	1.61	1.36 - 1.90
48506	73	62.10	1.18	0.96 - 1.43
48507	73	72.42	1.01	0.82 - 1.22
48509	27	23.21	1.16	0.82 - 1.60
48519	18	15.00	1.20	0.78 - 1.78
48529	22	19.17	1.15	0.78 - 1.64
48504 + 48532	106	108.19	0.98	0.83 - 1.15

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Esophagus cases were defined by new malignant cancer diagnoses where the primary site was the esophagus.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value of 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

^ To protect the identity of persons who have been diagnosed with cancer, counts less than six are not presented in this report. Complementary suppression is also applied to prevent the possibility of deducing suppressed data.

### Hodgkin Lymphoma (Table 7, Figure 17)

For Hodgkin lymphoma, two ZIP code areas (48438 and 48503) had lower than expected cases. None of the ZIP codes analyzed showed increased cases of Hodgkin Lymphoma.

**Table 7. Standardized Incidence Ratios (SIR)<sup>1</sup> of Hodgkin Lymphoma Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	25	19.90	1.26	0.87 - 1.75
48423	26	27.04	0.96	0.67 - 1.33
48433	23	22.23	1.03	0.71 - 1.47
48436	^	^	1.64	0.65 - 3.45
48438	^	^	0.20	0.01 - 0.93
48439	26	34.15	0.76	0.53 - 1.06
48451	8	10.72	0.75	0.37 - 1.35
48457	8	7.21	1.11	0.55 - 2.00
48458	20	21.48	0.93	0.62 - 1.35
48463	^	^	0.49	0.08 - 1.53
48473	24	17.76	1.35	0.93 - 1.90
48503	17	27.17	0.63	0.40 - 0.94
48505	29	31.64	0.92	0.66 - 1.25
48506	30	29.72	1.01	0.73 - 1.37
48507	33	31.66	1.04	0.76 - 1.39
48509	7	8.78	0.80	0.37 - 1.50
48519	^	^	0.49	0.13 - 1.26
48529	6	9.86	0.61	0.26 - 1.20
48504 + 48532	56	50.46	1.11	0.88 - 1.39

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Hodgkin lymphoma cancer cases were defined by new malignant cancer diagnoses where the primary type was Hodgkin lymphoma. Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value of 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

^ To protect the identity of persons who have been diagnosed with cancer, counts less than six are not presented in this report. Complementary suppression is also applied to prevent the possibility of deducing suppressed data.

### Kidney and Renal Pelvis (Table 8, Figure 18)

There were two ZIP code areas with lower than expected kidney and renal pelvis cases: 48451 and 48506. ZIP code 48420 showed a 18 percent increase (95% CI 1% – 37%).

**Table 8. Standardized Incidence Ratios (SIR)<sup>1</sup> of Kidney and Renal Pelvis Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	123	104.00	1.18	1.01 - 1.37
48423	132	137.16	0.96	0.83 - 1.11
48433	133	134.74	0.99	0.85 - 1.14
48436	10	14.36	0.70	0.38 - 1.18
48438	25	25.44	0.98	0.68 - 1.37
48439	164	180.52	0.91	0.80 - 1.03
48451	39	55.18	0.71	0.53 - 0.92
48457	41	37.17	1.10	0.84 - 1.43
48458	122	108.54	1.12	0.96 - 1.31
48463	22	22.33	0.99	0.67 - 1.41
48473	113	99.31	1.14	0.97 - 1.33
48503	138	143.23	0.96	0.83 - 1.11
48505	158	143.26	1.10	0.96 - 1.26
48506	117	142.66	0.82	0.70 - 0.96
48507	151	164.57	0.92	0.80 - 1.05
48509	55	51.36	1.07	0.84 - 1.34
48519	41	34.06	1.20	0.91 - 1.56
48529	44	44.31	0.99	0.76 - 1.28
48504 + 48532	235	244.85	0.96	0.86 - 1.07

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Kidney and renal pelvis cancer cases were defined by new malignant cancer diagnoses where the primary site was the kidney or renal pelvis.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value of 1.0) (Byar approximation of the Exact Test, Poisson Distribution)



### Larynx (Table 9, Figure 19)

There were five ZIP code areas (48423, 48438, 48451, 48473, and 48507) with lower than expected cases. There were also five ZIP codes that showed increases in larynx cancer cases. Increases consisted of 53 percent for ZIP code 48457 (95% CI 3% – 21%), 33 percent for ZIP code 48458 (95% CI 5% – 67%), 53 percent for ZIP code 48503 (95% CI 25% – 85%), 82 percent for ZIP code 48505 (95% CI 52% – 116%), and 30 percent for ZIP code 48506 (95% CI 5% – 59%).

**Table 9. Standardized Incidence Ratios (SIR)<sup>1</sup> of Larynx Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	37	38.69	0.96	0.71 - 1.26
48423	32	49.99	0.64	0.47 - 0.86
48433	39	49.15	0.79	0.60 - 1.04
48436	^	^	0.35	0.06 - 1.11
48438	^	^	0.30	0.08 - 0.78
48439	53	66.90	0.79	0.62 - 1.00
48451	9	20.79	0.43	0.23 - 0.76
48457	21	13.70	1.53	1.03 - 2.21
48458	53	39.78	1.33	1.05 - 1.67
48463	6	8.75	0.69	0.30 - 1.35
48473	22	37.30	0.59	0.40 - 0.84
48503	76	49.65	1.53	1.25 - 1.85
48505	94	51.73	1.82	1.52 - 2.16
48506	67	51.62	1.30	1.05 - 1.59
48507	44	57.94	0.76	0.58 - 0.98
48509	13	19.03	0.68	0.40 - 1.09
48519	15	12.17	1.23	0.76 - 1.90
48529	16	16.14	0.99	0.62 - 1.51
48504 + 48532	91	88.21	1.03	0.86 - 1.23

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Larynx cancer cases were defined by new malignant cancer diagnoses where the primary site was the larynx.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

^ To protect the identity of persons who have been diagnosed with cancer, counts less than six are not presented in this report.

Complementary suppression is also applied to prevent the possibility of deducing suppressed data.

### Leukemia (Table 10, Figure 20)

For leukemia, two ZIP codes (48505 and 48529) indicated lower than expected cases while one ZIP code (48439) had higher than expected cases. This is an increase of 15 percent (95% CI 2% – 31%).

**Table 10. Standardized Incidence Ratios (SIR)<sup>1</sup> of Leukemia Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	92	88.73	1.04	0.87 - 1.23
48423	118	117.91	1.00	0.85 - 1.17
48433	124	115.64	1.07	0.92 - 1.24
48436	16	11.66	1.37	0.86 - 2.08
48438	19	20.72	0.92	0.60 - 1.35
48439	177	153.29	1.15	1.02 - 1.31
48451	36	46.29	0.78	0.58 - 1.03
48457	27	31.82	0.85	0.60 - 1.17
48458	96	94.19	1.02	0.85 - 1.21
48463	20	18.16	1.10	0.73 - 1.60
48473	83	83.23	1.00	0.82 - 1.20
48503	112	128.50	0.87	0.74 - 1.02
48505	108	128.20	0.84	0.71 - 0.99
48506	125	124.68	1.00	0.86 - 1.16
48507	145	145.57	1.00	0.86 - 1.14
48509	49	43.55	1.13	0.87 - 1.43
48519	28	29.51	0.95	0.67 - 1.30
48529	26	38.72	0.67	0.47 - 0.93
48504 + 48532	212	220.84	0.96	0.85 - 1.08

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Leukemia cancer cases were defined by new malignant cancer diagnoses where the primary type was leukemia.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

Lip, Oral Cavity, and Pharynx (Table 11, Figure 21)

One ZIP code area, 48463, had an elevated number of lip, oral cavity, and pharynx cancers. This ZIP code showed an increase of 50 percent (95% CI 6% – 107%).

**Table 11. Standardized Incidence Ratios (SIR)<sup>1</sup> of Lip, Oral Cavity, and Pharynx Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	74	81.74	0.91	0.74 - 1.10
48423	100	106.61	0.94	0.79 - 1.11
48433	90	103.38	0.87	0.73 - 1.04
48436	14	11.83	1.18	0.72 - 1.85
48438	17	20.79	0.82	0.52 - 1.23
48439	129	141.58	0.91	0.78 - 1.05
48451	38	43.88	0.87	0.65 - 1.14
48457	24	29.13	0.82	0.57 - 1.16
48458	95	83.69	1.14	0.95 - 1.35
48463	27	18.03	1.50	1.06 - 2.07
48473	83	77.85	1.07	0.88 - 1.28
48503	100	107.66	0.93	0.78 - 1.10
48505	125	109.71	1.14	0.98 - 1.32
48506	119	110.70	1.07	0.92 - 1.25
48507	128	124.86	1.03	0.88 - 1.19
48509	45	39.69	1.13	0.87 - 1.45
48519	19	26.10	0.73	0.48 - 1.07
48529	32	34.71	0.92	0.67 - 1.24
48504 + 48532	176	189.02	0.93	0.82 - 1.06

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Lip, oral cavity, and pharynx cancer cases were defined by new malignant cancer diagnoses where the primary site was the lip, oral cavity, or pharynx.

Shading indicates that the SIR was statistically higher than 1.00. (95 percent confidence interval does not include the value 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

### Liver and Intrahepatic Bile Ducts (Table 12, Figure 22)

For liver and intrahepatic bile duct cancers, one ZIP code, 48473, showed lower than expected cases. Two ZIP codes had an elevated number of liver and intrahepatic bile duct cancers, 48503 and 48505. 48503 showed an increase of 28 percent (95% CI 3% – 58%). ZIP code 48505 had a 37 percent increase (95% CI 10% – 68%).

**Table 12. Standardized Incidence Ratios (SIR)<sup>1</sup> of Liver and Intrahepatic Bile Duct Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	28	35.46	0.79	0.56 - 1.08
48423	35	46.25	0.76	0.56 - 1.00
48433	41	46.62	0.88	0.67 - 1.14
48436	6	4.77	1.26	0.55 - 2.48
48438	8	8.46	0.95	0.47 - 1.71
48439	52	61.17	0.85	0.67 - 1.07
48451	20	18.50	1.08	0.72 - 1.57
48457	9	12.59	0.71	0.37 - 1.25
48458	42	36.43	1.15	0.88 - 1.49
48463	^	^	0.53	0.18 - 1.21
48473	20	33.73	0.59	0.39 - 0.86
48503	63	49.08	1.28	1.03 - 1.58
48505	65	47.57	1.37	1.10 - 1.68
48506	46	47.81	0.96	0.74 - 1.23
48507	55	56.04	0.98	0.77 - 1.23
48509	13	17.57	0.74	0.44 - 1.18
48519	12	11.64	1.03	0.59 - 1.67
48529	21	14.72	1.43	0.96 - 2.05
48504 + 48532	86	81.58	1.05	0.87 - 1.26

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Liver and intrahepatic bile duct cancer cases were defined by new malignant cancer diagnoses where the primary site was the liver or intrahepatic bile duct.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

^ To protect the identity of persons who have been diagnosed with cancer, counts less than six are not presented in this report.

Complementary suppression is also applied to prevent the possibility of deducing suppressed data.

### Lung and Bronchus (Table 13, Figure 23)

Six ZIP code areas (48423, 48433, 48436, 48438, 48439, and 48473) had lower than expected lung and bronchus cancer cases. Five ZIP codes had increased lung and bronchus cancers, which were 48458, 48505, 48506, 48507, and 48529. ZIP code 48458 had an increase of 19 percent (95% CI 12% – 27%). ZIP code 48505 had an increase of 31 percent (95% CI 24% – 38%). ZIP code 48506 had an increase of 19 percent (95% CI 12% – 25%). ZIP code 48507 had an increase of 10 percent (95% CI 5% – 16%). ZIP code 48529 had an increase of 39 percent (95% CI 26% – 52%).

**Table 13. Standardized Incidence Ratios (SIR)<sup>1</sup> of Lung & Bronchus Cancers Duct Cancers by Zip Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	544	550.40	0.99	0.92 - 1.06
48423	664	733.22	0.91	0.85 - 0.97
48433	585	741.12	0.79	0.74 - 0.85
48436	53	71.13	0.75	0.59 - 0.94
48438	86	127.41	0.67	0.56 - 0.81
48439	748	956.21	0.78	0.74 - 0.83
48451	265	285.90	0.93	0.84 - 1.03
48457	196	195.83	1.00	0.89 - 1.13
48458	698	585.47	1.19	1.12 - 1.27
48463	98	115.98	0.84	0.71 - 1.00
48473	434	531.88	0.82	0.75 - 0.88
48503	773	792.03	0.98	0.92 - 1.04
48505	999	765.05	1.31	1.24 - 1.38
48506	897	756.44	1.19	1.12 - 1.25
48507	997	903.11	1.10	1.05 - 1.16
48509	310	282.32	1.10	1.00 - 1.21
48519	194	185.62	1.05	0.92 - 1.18
48529	321	231.32	1.39	1.26 - 1.52
48504 + 48532	1,285	1,336.09	0.96	0.92 - 1.01

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985-2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Lung and bronchus cancer cases were defined by new malignant cancer diagnoses where the primary site was the lung or bronchus.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

### Melanoma of the Skin (Table 14, Figure 24)

Six ZIP code areas (48458, 48503, 48505, 48506, 48529, and 48504 and 48532 combined) had lower than expected melanoma cases; five ZIP codes (48423, 48438, 48439, 48451, and 48473) had higher than expected melanoma cases. For skin melanoma cancers, ZIP code 48423 indicated an increase of 26 percent (95% CI 11% – 43%). ZIP code 48438 had an increase of 55 percent (95% CI 14% – 100%). ZIP code 48439 had an increase of 67 percent (95% CI 52% – 84%). ZIP code 48451 had an increase of 40 percent (95% CI 15% – 69%). ZIP code 48473 had an increase of 33 percent (95% CI 14% – 54%).

**Table 14. Standardized Incidence Ratios (SIR)<sup>1</sup> of Melanoma of the Skin Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	111	104.54	1.06	0.90 - 1.24
48423	175	138.75	1.26	1.11 - 1.43
48433	147	130.63	1.13	0.98 - 1.29
48436	16	15.17	1.05	0.66 - 1.60
48438	41	26.53	1.55	1.17 - 2.00
48439	305	182.59	1.67	1.52 - 1.84
48451	79	56.40	1.40	1.15 - 1.69
48457	44	37.29	1.18	0.90 - 1.52
48458	76	109.56	0.69	0.57 - 0.84
48463	22	22.59	0.97	0.66 - 1.39
48473	132	99.34	1.33	1.14 - 1.54
48503	65	140.49	0.46	0.37 - 0.57
48505	19	147.31	0.13	0.08 - 0.19
48506	121	145.19	0.83	0.71 - 0.97
48507	156	163.21	0.96	0.83 - 1.09
48509	51	50.10	1.02	0.80 - 1.29
48519	35	33.48	1.05	0.77 - 1.39
48529	32	46.20	0.69	0.50 - 0.93
48504 + 48532	122	246.13	0.50	0.42 - 0.58

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Melanoma of the skin cancer cases were defined by new malignant cancer diagnoses where the primary type was melanoma of the skin. Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

### Multiple Myeloma (Table 15, Figure 25)

One ZIP code (48433) had lower than expected cases. Two ZIP code areas (48505 and 48504 and 48532 combined) had higher than expected multiple myeloma cases. ZIP code 48505 showed an increase of 61 percent (95% CI 35% – 91%). Combined ZIP codes 48504 and 48532 had an increase of 18 percent (95% CI 1% – 37%).

**Table 15. Standardized Incidence Ratios (SIR)<sup>1</sup> of Multiple Myeloma Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	41	43.42	0.94	0.72 - 1.23
48423	50	57.94	0.86	0.67 - 1.09
48433	42	58.78	0.71	0.54 - 0.92
48436	6	5.51	1.09	0.47 - 2.15
48438	^	^	0.51	0.20 - 1.06
48439	81	75.37	1.07	0.89 - 1.29
48451	24	22.42	1.07	0.74 - 1.51
48457	12	15.49	0.77	0.45 - 1.25
48458	41	45.98	0.89	0.68 - 1.16
48463	^	^	0.44	0.15 - 1.02
48473	44	41.74	1.05	0.81 - 1.36
48503	71	63.42	1.12	0.91 - 1.36
48505	97	60.12	1.61	1.35 - 1.91
48506	53	59.81	0.89	0.70 - 1.11
48507	61	71.99	0.85	0.68 - 1.05
48509	22	22.22	0.99	0.67 - 1.41
48519	14	14.79	0.95	0.57 - 1.48
48529	14	18.22	0.77	0.46 - 1.20
48504 + 48532	124	105.41	1.18	1.01 - 1.37

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Multiple myeloma cancer cases were defined by new malignant cancer diagnoses where the primary type was multiple myeloma.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

^ To protect the identity of persons who have been diagnosed with cancer, counts less than six are not presented in this report. Complementary suppression is also applied to prevent the possibility of deducing suppressed data.

### Non-Hodgkin Lymphoma (Table 16, Figure 26)

Three ZIP code areas (48503, 48505, and 48504 and 48532 combined) indicated lower than expected cases. Three ZIP codes showed increases in non-Hodgkin lymphoma, 48423, 48433, and 48473. ZIP code 48423 showed an increase of 14 percent (95% CI 1% – 28%). ZIP code 48433 had an increase of 16 percent (95% CI 3% – 30%). ZIP code 48473 had an increase of 22 percent (95% CI 6% – 39%).

**Table 16. Standardized Incidence Ratios (SIR)<sup>1</sup> of Non-Hodgkin Lymphoma Cancers Duct Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	141	133.51	1.06	0.91 - 1.21
48423	203	178.58	1.14	1.01 - 1.28
48433	203	175.47	1.16	1.03 - 1.30
48436	21	17.65	1.19	0.8 - 1.71
48438	38	31.41	1.21	0.91 - 1.59
48439	258	232.28	1.11	1.00 - 1.23
48451	71	70.06	1.01	0.82 - 1.23
48457	44	47.81	0.92	0.7 - 1.18
48458	124	141.25	0.88	0.75 - 1.02
48463	31	27.76	1.12	0.81 - 1.51
48473	155	127.16	1.22	1.06 - 1.39
48503	161	191.84	0.84	0.73 - 0.96
48505	146	187.48	0.78	0.68 - 0.89
48506	171	186.17	0.92	0.81 - 1.04
48507	216	218.82	0.99	0.88 - 1.10
48509	69	66.60	1.04	0.84 - 1.27
48519	44	44.75	0.98	0.75 - 1.26
48529	49	57.67	0.85	0.66 - 1.08
48504 + 48532	257	324.16	0.79	0.71 - 0.88

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Non-Hodgkin lymphoma cancer cases were defined by new malignant cancer diagnoses where the primary type was non-Hodgkin lymphoma.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value 1.0) (Byar approximation of the Exact Test, Poisson Distribution)



### Ovarian (Table 17, Figure 27)

One ZIP code (48439) had higher than expected ovarian cancer cases. ZIP code 48439 had 20 percent greater than expected ovarian cancer cases (95% CI 3% – 30%). The number of cases was 117 and the expected number was 97.25.

**Table 17. Standardized Incidence Ratios (SIR)<sup>1</sup> of Ovarian Cancer in Females by ZIP Code of Residence, Adjusted for Age, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	48	55.24	0.87	0.67 - 1.11
48423	79	76.31	1.04	0.85 - 1.25
48433	79	72.89	1.08	0.89 - 1.31
48436	7	7.17	0.98	0.46 - 1.83
48438	18	12.74	1.41	0.91 - 2.09
48439	117	97.25	1.20	1.03 - 1.40
48451	26	28.76	0.90	0.63 - 1.25
48457	25	20.13	1.24	0.86 - 1.73
48458	58	59.06	0.98	0.78 - 1.22
48463	10	11.11	0.90	0.49 - 1.53
48473	56	52.39	1.07	0.85 - 1.34
48503	71	83.08	0.85	0.69 - 1.04
48505	71	81.18	0.87	0.71 - 1.07
48506	70	79.28	0.88	0.72 - 1.08
48507	85	94.69	0.90	0.74 - 1.08
48509	27	26.79	1.01	0.71 - 1.39
48519	22	19.47	1.13	0.76 - 1.61
48529	21	24.36	0.86	0.58 - 1.24
48504 + 48532	134	144.52	0.93	0.80 - 1.07

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Ovarian cancer cases were defined by new malignant cancer diagnoses where the primary site the ovaries in females.

Shading indicates that the SIR was statistically higher than 1.00. (95 percent confidence interval does not include the value 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

### Pancreas (Table 18, Figure 28)

For cancers of the pancreas, two ZIP codes (48420 and 48503) had lower than expected cases. One ZIP code (48505) had higher than expected cases. ZIP code 48505 had 27 percent greater pancreatic cancer cases (95% CI 11% – 46%) than expected based on county rates. The number of cases was 153 and the expected number was 120.21.

**Table 18. Standardized Incidence Ratios (SIR)<sup>1</sup> of Pancreas Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	67	87.98	0.76	0.62 - 0.93
48423	122	117.53	1.04	0.89 - 1.21
48433	116	119.72	0.97	0.83 - 1.13
48436	16	10.86	1.47	0.92 - 2.24
48438	18	19.54	0.92	0.60 - 1.37
48439	142	152.38	0.93	0.81 - 1.07
48451	45	44.95	1.00	0.77 - 1.28
48457	30	31.54	0.95	0.68 - 1.29
48458	100	91.77	1.09	0.92 - 1.29
48463	18	17.75	1.01	0.66 - 1.50
48473	82	83.53	0.98	0.81 - 1.18
48503	108	131.20	0.82	0.70 - 0.97
48505	153	120.21	1.27	1.11 - 1.46
48506	108	121.35	0.89	0.75 - 1.04
48507	148	147.81	1.00	0.87 - 1.15
48509	47	44.47	1.06	0.82 - 1.35
48519	38	30.47	1.25	0.93 - 1.63
48529	38	36.72	1.03	0.78 - 1.36
48504 + 48532	232	216.71	1.07	0.96 - 1.19

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Pancreas cancer cases were defined by new malignant cancer diagnoses where the primary site was the pancreas.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

### Prostate (Table 19, Figure 29)

Seven ZIP code areas (48451, 48457, 48458, 48463, 48506, 48519, and 48529) indicated fewer prostate cases than expected. Two ZIP codes showed increased levels of prostate cancer, 48505 and combined ZIP codes 48504 and 48532. ZIP code 48505 showed an increase of 23 percent (95% CI 16% – 29). Combined ZIP codes 48504 and 48532 showed an increase of 7 percent (95% CI 2% – 12%).

**Table 19. Standardized Incidence Ratios (SIR)<sup>1</sup> of Prostate Cancer in Males by ZIP Code of Residence, Adjusted for Age, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	527	551.35	0.96	0.89 - 1.03
48423	714	707.92	1.01	0.95 - 1.07
48433	738	734.17	1.01	0.95 - 1.07
48436	80	75.35	1.06	0.87 - 1.28
48438	125	133.65	0.94	0.80 - 1.09
48439	987	950.84	1.04	0.98 - 1.09
48451	258	290.41	0.89	0.80 - 0.98
48457	157	192.12	0.82	0.71 - 0.93
48458	509	584.64	0.87	0.81 - 0.94
48463	102	122.06	0.84	0.70 - 0.99
48473	541	540.31	1.00	0.93 - 1.08
48503	761	735.32	1.03	0.97 - 1.10
48505	916	747.75	1.23	1.16 - 1.29
48506	560	729.46	0.77	0.72 - 0.82
48507	807	847.96	0.95	0.90 - 1.01
48509	302	286.68	1.05	0.96 - 1.16
48519	140	173.63	0.81	0.70 - 0.93
48529	174	226.20	0.77	0.68 - 0.87
48504 + 48532	1,372	1,283.04	1.07	1.02 - 1.12

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Prostate cancer cases were defined by new malignant cancer diagnoses where the primary site was the prostate in males.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

### Stomach (Table 20, Figure 30)

For stomach cancer, three ZIP code areas (48423, 48433, and 48473) had less cases than expected. Three ZIP codes showed increased levels of stomach cancer (48458, 48503, and 48505). ZIP code 48458 had an increase of 32 percent (95% CI 6% – 62%). ZIP code 48503 had an increase of 24 percent (95% CI 2% – 48%). ZIP code 48505 had an increase of 85 percent (95% CI 58% – 115%).

**Table 20. Standardized Incidence Ratios (SIR)<sup>1</sup> of Stomach Cancers by ZIP Code of Residence, Adjusted for Age and Sex 1985 - 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	52	47.34	1.10	0.86 - 1.38
48423	46	62.75	0.73	0.56 - 0.94
48433	48	63.69	0.75	0.58 - 0.96
48436	^	^	0.66	0.23 - 1.52
48438	6	10.80	0.56	0.24 - 1.10
48439	72	82.08	0.88	0.71 - 1.07
48451	28	24.43	1.15	0.81 - 1.57
48457	10	16.82	0.59	0.32 - 1.01
48458	65	49.43	1.32	1.06 - 1.62
48463	9	9.72	0.93	0.48 - 1.62
48473	26	45.12	0.58	0.40 - 0.80
48503	85	68.78	1.24	1.02 - 1.48
48505	119	64.46	1.85	1.58 - 2.15
48506	71	64.82	1.10	0.89 - 1.33
48507	70	77.85	0.90	0.73 - 1.10
48509	31	23.87	1.30	0.94 - 1.75
48519	10	16.00	0.63	0.34 - 1.06
48529	17	19.86	0.86	0.55 - 1.28
48504 + 48532	107	117.43	0.91	0.77 - 1.07

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985-2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Stomach cancer cases were defined by new malignant cancer diagnoses where the primary site was the stomach.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

^ To protect the identity of persons who have been diagnosed with cancer, counts less than six are not presented in this report. Complementary suppression is also applied to prevent the possibility of deducing suppressed data.

### Testicular (Table 21, Figure 31)

There were four ZIP code areas (48439, 48503, 48505, and 48504 and 48532 combined) with fewer than expected testicular cancer cases. Three ZIP codes had statistically more cases than expected: 48423, 48438, and 48506. ZIP code 48423 had an increase of increase of 38 percent (95% CI 0% – 86%). ZIP code 48438 had an increase of 93 percent (95% CI 1% – 237%). ZIP code 48506 had an increase of 49 percent (95% CI 11% – 96%).

**Table 21. Standardized Incidence Ratios (SIR)<sup>1</sup> of Testicular Cancers in Males by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	19	16.83	1.13	0.74 - 1.66
48423	31	22.44	1.38	1.00 - 1.86
48433	16	17.49	0.91	0.57 - 1.39
48436	^	^	1.45	0.49 - 3.32
48438	9	4.66	1.93	1.01 - 3.37
48439	18	28.84	0.62	0.40 - 0.93
48451	10	9.53	1.05	0.57 - 1.78
48457	10	6.17	1.62	0.88 - 2.75
48458	14	17.00	0.82	0.50 - 1.29
48463	^	^	1.13	0.38 - 2.57
48473	19	14.65	1.30	0.85 - 1.90
48503	12	21.30	0.56	0.32 - 0.91
48505	8	23.55	0.34	0.17 - 0.61
48506	37	24.79	1.49	1.11 - 1.96
48507	24	24.80	0.97	0.67 - 1.36
48509	7	7.10	0.99	0.46 - 1.85
48519	^	^	1.01	0.40 - 2.13
48529	^	^	0.59	0.23 - 1.25
48504 + 48532	28	39.27	0.71	0.51 - 0.98

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Testicular cancer cases were defined by new malignant cancer diagnoses where the primary site was the testis in males.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

^ To protect the identity of persons who have been diagnosed with cancer, counts less than six are not presented in this report.

Complementary suppression is also applied to prevent the possibility of deducing suppressed data.

### Thyroid Gland (Table 22, Figure 32)

There were four ZIP code areas (48503, 48505, 48529, and 48504 and 48532 combined) with lower than expected thyroid gland cancers. Three ZIP codes had statistically more cases than expected: 48420, 48438, and 48439. ZIP code 48420 an increase of 24 percent (95% CI 2% – 49%). ZIP code 48438 had an increase of 48 percent (95% CI 4% – 106%). ZIP code 48439 an increase of 21 percent (95% CI 5% – 40%).

**Table 22. Standardized Incidence Ratios (SIR)<sup>1</sup> of Thyroid Gland Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	83	67.00	1.24	1.02 - 1.49
48423	99	90.95	1.09	0.91 - 1.29
48433	69	80.74	0.85	0.69 - 1.04
48436	11	10.14	1.08	0.61 - 1.80
48438	26	17.51	1.48	1.04 - 2.06
48439	144	118.52	1.21	1.05 - 1.40
48451	44	36.75	1.20	0.92 - 1.54
48457	25	24.12	1.04	0.72 - 1.45
48458	59	71.33	0.83	0.66 - 1.03
48463	15	14.35	1.05	0.64 - 1.61
48473	63	63.24	1.00	0.80 - 1.23
48503	62	90.22	0.69	0.55 - 0.85
48505	51	100.06	0.51	0.40 - 0.64
48506	91	96.06	0.95	0.79 - 1.13
48507	104	105.96	0.98	0.83 - 1.16
48509	40	30.73	1.30	0.98 - 1.69
48519	26	21.51	1.21	0.85 - 1.68
48529	14	31.16	0.45	0.27 - 0.70
48504 + 48532	130	162.49	0.80	0.69 - 0.93

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Thyroid cancer cases were defined by new malignant cancer diagnoses where the primary site was the thyroid gland.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

## Urinary Bladder (Table 23, Figure 33)

For urinary bladder cancers, two ZIP codes (48503 and 48505) had lower than expected cases. Two ZIP codes indicated an elevated number of urinary bladder cancers: 48451 and 48509. ZIP code 48451 showed an increase of 23 percent (95% CI 3% – 45%). ZIP code 48509 had an increase of 23 percent (95% CI 3% – 45%).

**Table 23. Standardized Incidence Ratios (SIR)<sup>1</sup> of Urinary Bladder Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	152	152.09	1.00	0.87 - 1.14
48423	218	200.26	1.09	0.97 - 1.22
48433	219	206.88	1.06	0.94 - 1.18
48436	22	19.12	1.15	0.78 - 1.64
48438	33	34.56	0.95	0.70 - 1.28
48439	257	263.64	0.97	0.88 - 1.08
48451	96	78.28	1.23	1.03 - 1.45
48457	48	53.11	0.90	0.70 - 1.15
48458	147	161.30	0.91	0.79 - 1.05
48463	35	31.64	1.11	0.82 - 1.47
48473	155	146.85	1.06	0.92 - 1.21
48503	177	219.19	0.81	0.71 - 0.91
48505	121	207.55	0.58	0.50 - 0.68
48506	221	206.04	1.07	0.96 - 1.20
48507	250	248.12	1.01	0.91 - 1.12
48509	97	78.71	1.23	1.03 - 1.46
48519	55	50.51	1.09	0.86 - 1.36
48529	59	63.47	0.93	0.74 - 1.15
48504 + 48532	350	367.09	0.95	0.87 - 1.04

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Urinary bladder cancer cases were defined by new malignant cancer diagnoses where the primary site was the urinary bladder.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value 1.0) (Byar approximation of the Exact Test, Poisson Distribution)

### All Other Types Not Evaluated Individually (Table 24, Figure 34)

For all other types not evaluated individually, three ZIP code areas (48433, 48473, and 48504 and 48532 combined) had lower than expected cases. Three ZIP codes indicated elevated numbers of cancers for all other types not evaluated individually: 48458, 48505, and 48506. ZIP code 48458 had an increase of 11 percent (95% CI 2% – 21%). ZIP code 48505 showed an increase of 19 percent (95% CI 11% – 29%). ZIP code 48506 had an increase of 9 percent (95% CI 1% – 18%).

**Table 24. Standardized Incidence Ratios (SIR)<sup>1</sup> of All Other Types Combined by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

ZIP Code	Observed	Expected <sup>1</sup>	SIR <sup>1</sup>	95 % CI
48420	268	294.49	0.91	0.82 - 1.01
48423	376	396.31	0.95	0.87 - 1.03
48433	347	386.92	0.90	0.82 - 0.98
48436	34	38.55	0.88	0.65 - 1.17
48438	55	68.48	0.80	0.63 - 1.01
48439	482	513.17	0.94	0.87 - 1.01
48451	133	153.73	0.87	0.75 - 1.00
48457	97	105.75	0.92	0.77 - 1.09
48458	347	312.21	1.11	1.02 - 1.21
48463	55	60.14	0.91	0.72 - 1.14
48473	241	278.77	0.86	0.77 - 0.96
48503	438	429.93	1.02	0.94 - 1.10
48505	503	421.04	1.19	1.11 - 1.29
48506	451	414.02	1.09	1.01 - 1.18
48507	503	489.18	1.03	0.95 - 1.11
48509	158	145.06	1.09	0.95 - 1.24
48519	85	99.74	0.85	0.71 - 1.02
48529	134	128.35	1.04	0.90 - 1.20
48504 + 48532	747	841.44	0.89	0.84 - 0.94

<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

All other types of cancer cases were defined by new malignant cancer diagnoses where the primary site was not one of those identified in Tables 2 through 23.

Shading indicates that the SIR was statistically higher or lower than 1.00. (95 percent confidence interval does not include the value 1.0) (Byar approximation of the Exact Test, Poisson Distribution)



## Conclusion

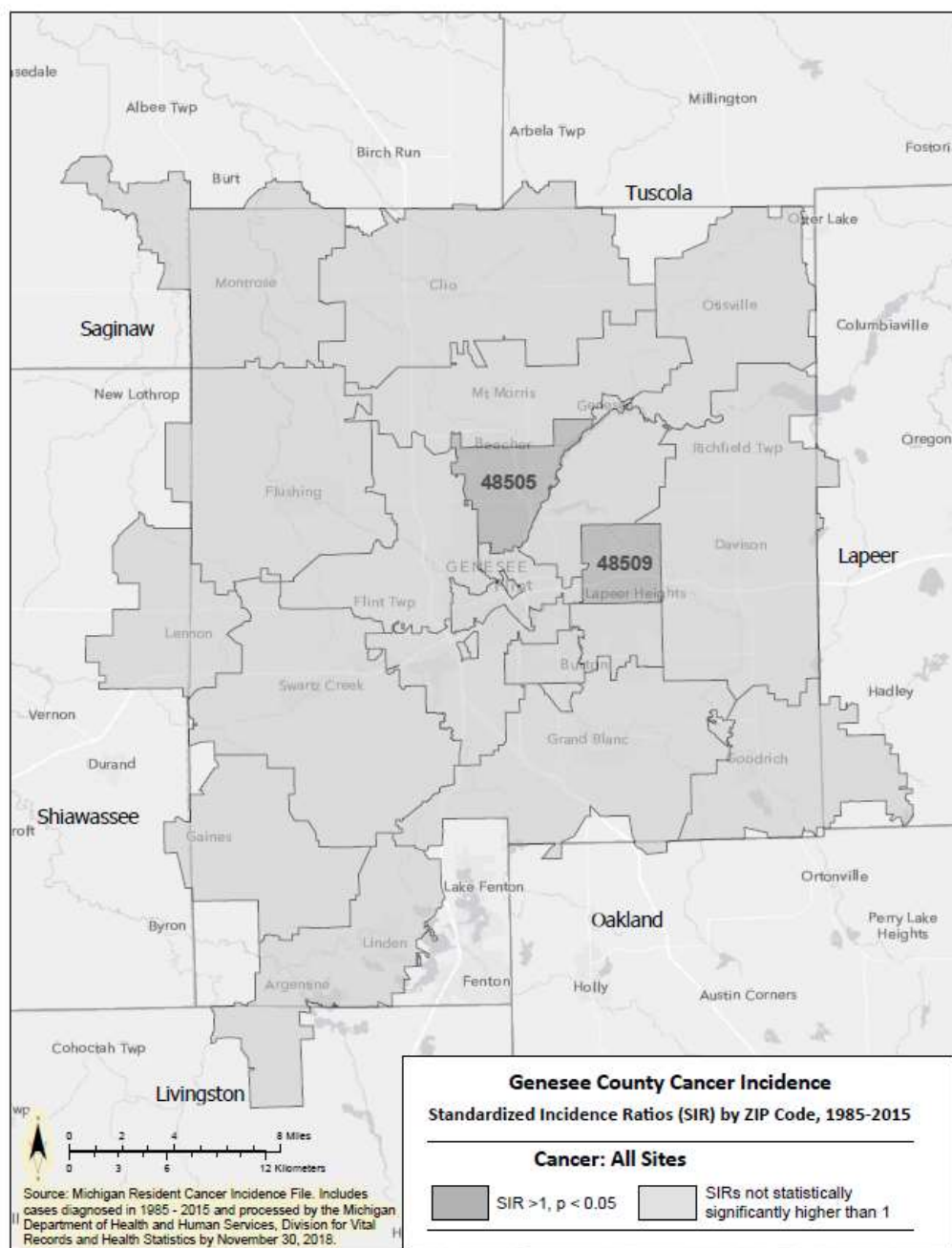
This cancer incidence review provides descriptive results of trends in cancer incidence rates in Genesee County between 1985 – 2015 (Part 1) and ZIP code level analysis for the combined years 1985 to 2015 compared to Genesee County as a whole (Part 2). Genesee County's total cancer incidence rate was higher than the State of Michigan for most years during 1985 to 2015. Rates of breast, colorectal, lung, and prostate cancer were not higher than the State of Michigan for most years during 1985 to 2015. Urban counties that are sociodemographically similar to Genesee County have rates of lung, female breast, and colorectal cancer that are not statistically different than Genesee County for most years during 1985 to 2015. Compared to the county, the frequency of cancers was higher than expected for some cancer types and in some ZIP codes and lower than expected in others. ZIP code 48505 stood out as having more statistical elevations in cancer incidence than other ZIP codes (11 elevated SIRs). This ZIP code also had eight SIRs that were statistically less than 1.00 (indicating less cancer cases than expected compared to the county for these cancer types). It should be noted that according to the US Census Bureau, this ZIP code (48505) has been undergoing large declines in population size since about 1990, losing 25 percent of its population between 2000 and 2010 alone. These changes in underlying demographics which are used to calculate SIR statistics can make the resulting estimate of the SIR less reliable. It is also important to consider the aforementioned limitations of the analysis and the registry-based cancer surveillance data (see above). Limitations that are particularly important are that (1) data from the Michigan Central Cancer Registry does not contain the information necessary to determine that cancer incidence is related to any environmental contamination, (2) given the long period of investigation, it is possible that the migration of people into and out of the analysis area is a mitigating factor in interpreting the findings. This investigation should be considered a descriptive review of cancer incidence in the ZIP codes of Genesee County and not as evidence that potential exposure to any environmental contaminant has resulted in higher or lower cancer risk. When reviewing multiple cancer types over multiple geographic areas, such as was done for this report, patterns of increased incidence in some geographic areas and decreased incidence in others is common. It must also be considered that increased or decreased cancer incidence in an area during a time period can occur by chance alone.

## References

1. Cancer clusters – About cancer clusters. Centers for Disease Control and Prevention (CDC). <https://www.cdc.gov/nceh/clusters/about.htm>. Updated May 14, 2019. Accessed September 20, 2019.
2. 1990-2017 Population Estimates. Michigan Department of Health and Human Services (MDHHS). <http://www.mdch.state.mi.us/pha/osr/CHI/POP/FRAME.ASP>. Accessed September 20, 2019.
3. QuickFacts. United States Census Bureau. <http://www.census.gov/quickfacts/fact/table/>. Updated September 17, 2020. Accessed September 21, 2020.
4. Profile of General Demographic Characteristics, 1990-2010 Census Summary File. United States Census Bureau. <https://data.census.gov/cedsci/>. Accessed September 20, 2019.
5. Monson RR. *Occupational Epidemiology*. Boca Raton, FL: CRC Press; 1990.

## Maps

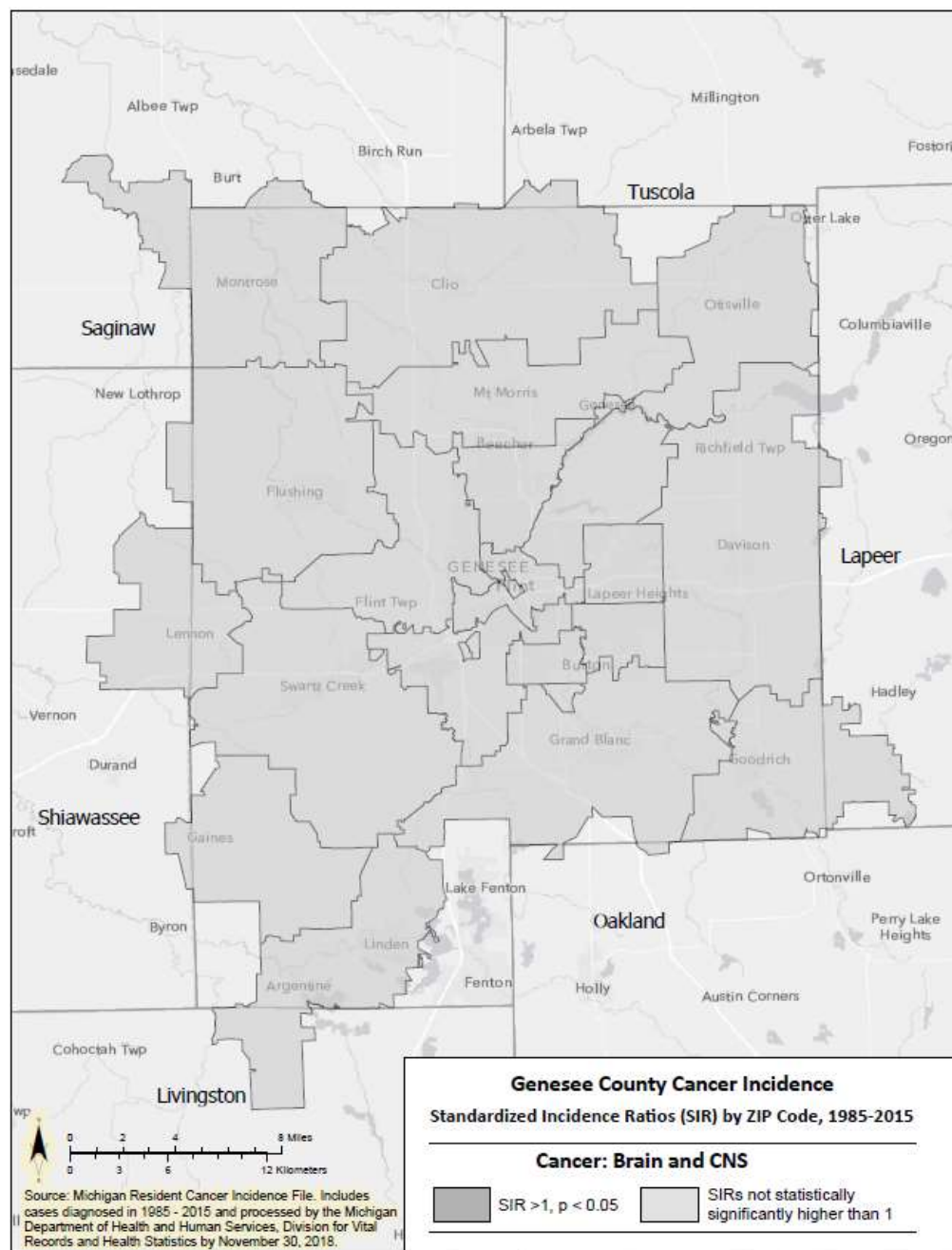
**Figure 11. Standardized Incidence Ratio (SIR)<sup>1</sup> for Total Cancer Cases (All Cancer Types Combined) by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**



<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

**Figure 12. Standardized Incidence Ratio (SIR)<sup>1</sup> for Brain or Other Central Nervous System Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

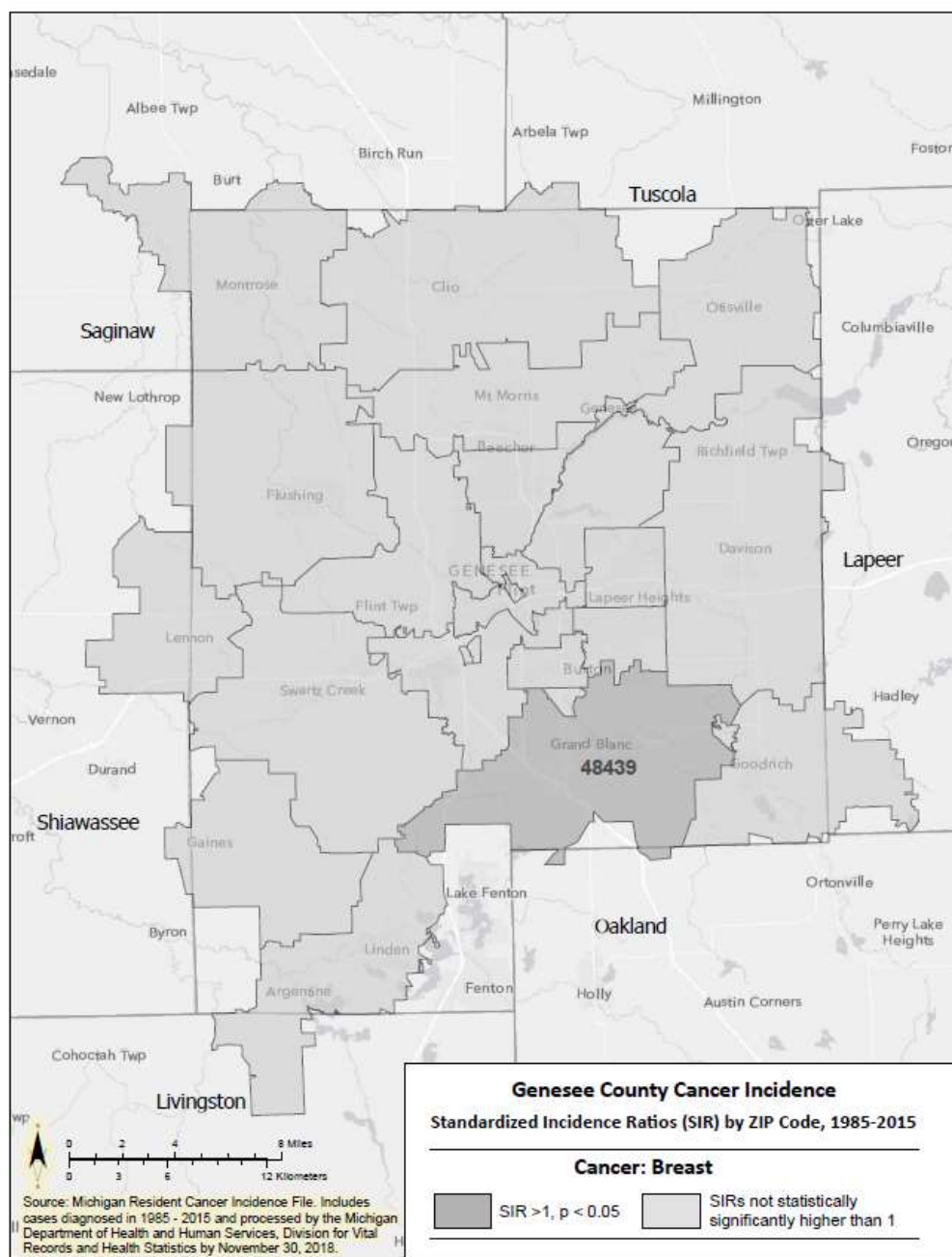


<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Brain and other central nervous system cancer cases were defined by new malignant cancer diagnoses where the primary site was the brain or other central nervous system.

**Figure 13. Standardized Incidence Ratio (SIR)<sup>1</sup> for Breast Cancer in Females by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

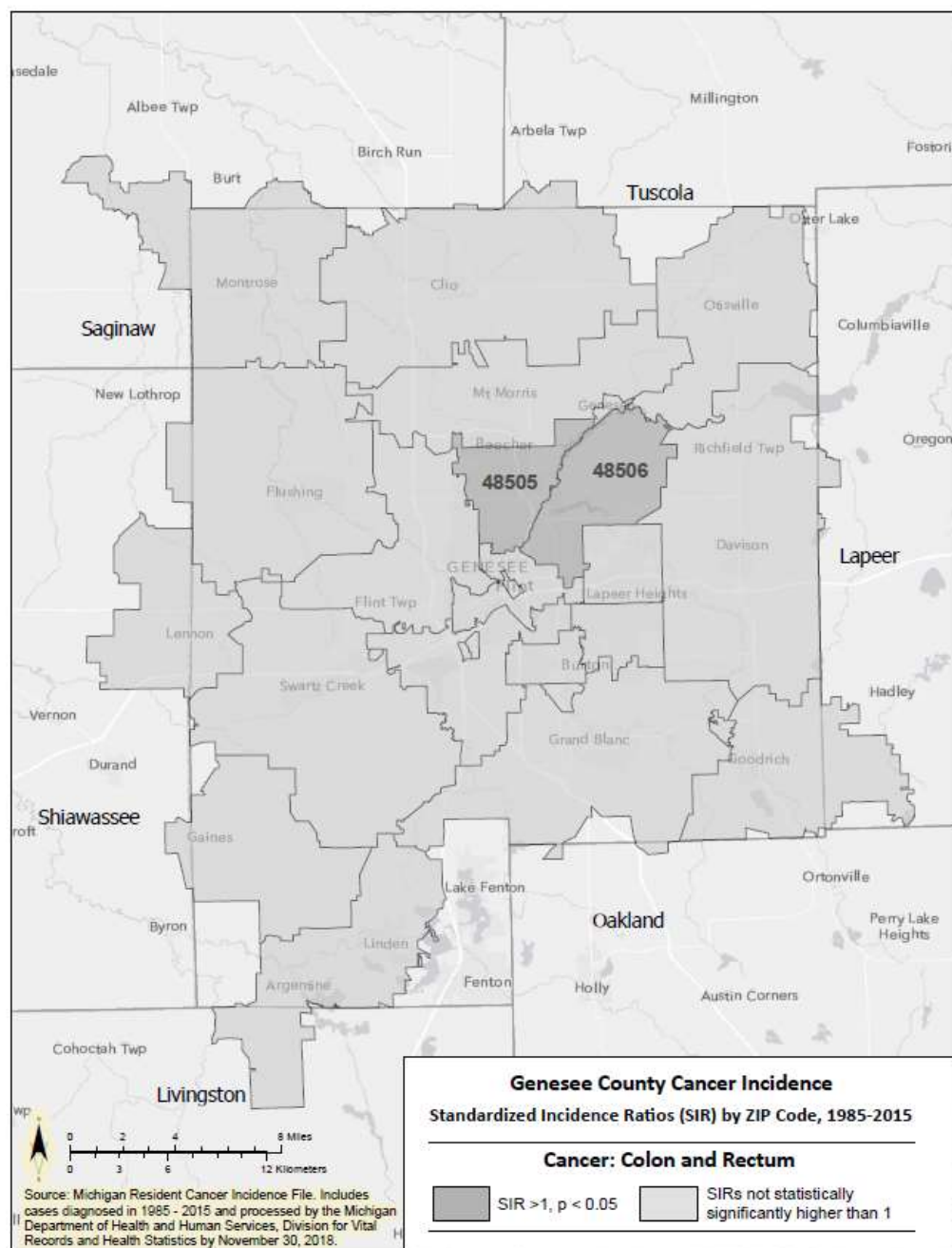


<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Female breast cancer cases were defined by new malignant cancer diagnoses where the primary site was the breast in females.

**Figure 14. Standardized Incidence Ratio (SIR)<sup>1</sup> for Colon and Rectal Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**



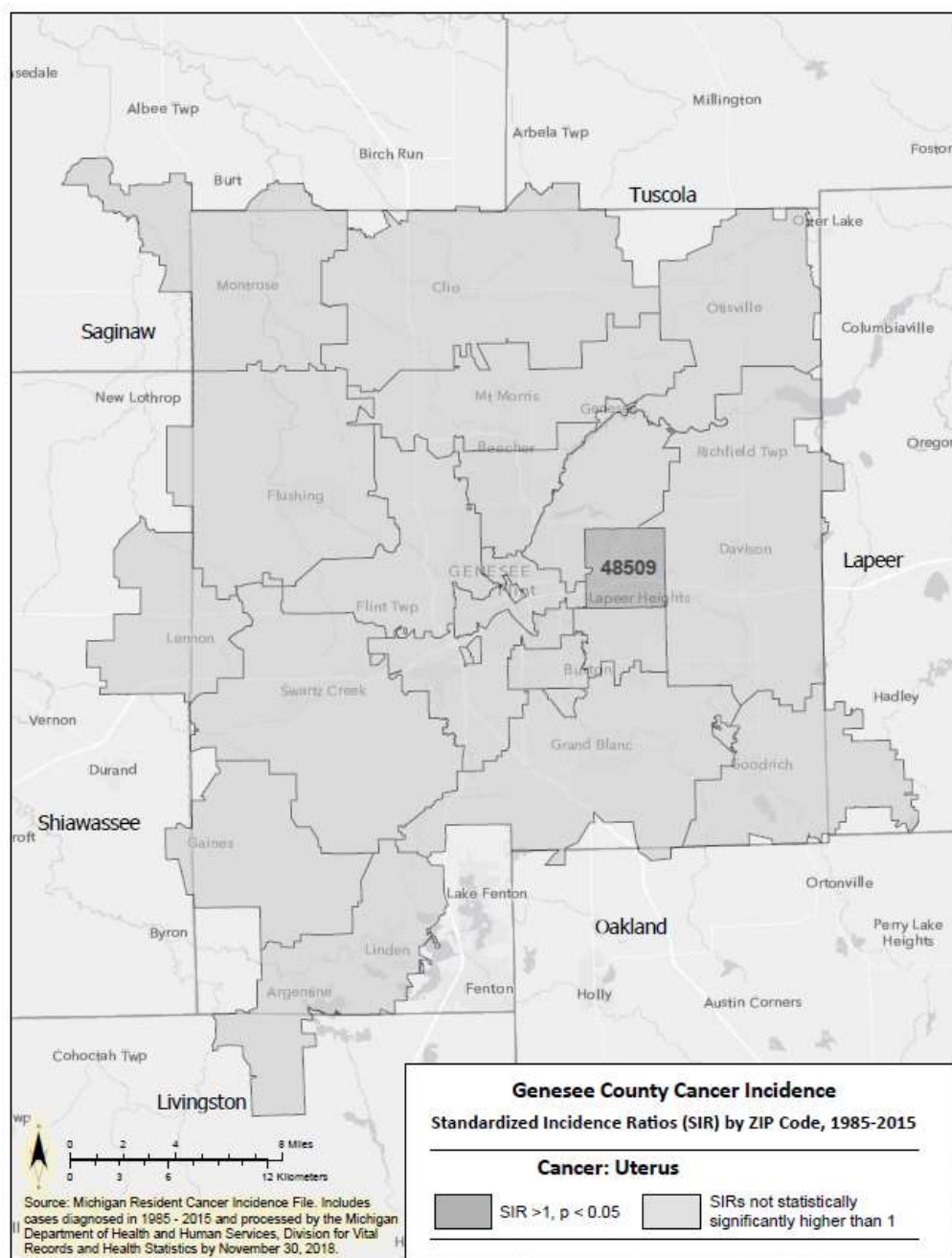
<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Colon and rectum cancer cases were defined by new malignant cancer diagnoses where the primary site was the colon or rectum.



**Figure 15. Standardized Incidence Ratio (SIR)<sup>1</sup> for Corpus Uteri and Uterus Cancers Not Other Specified in Females by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

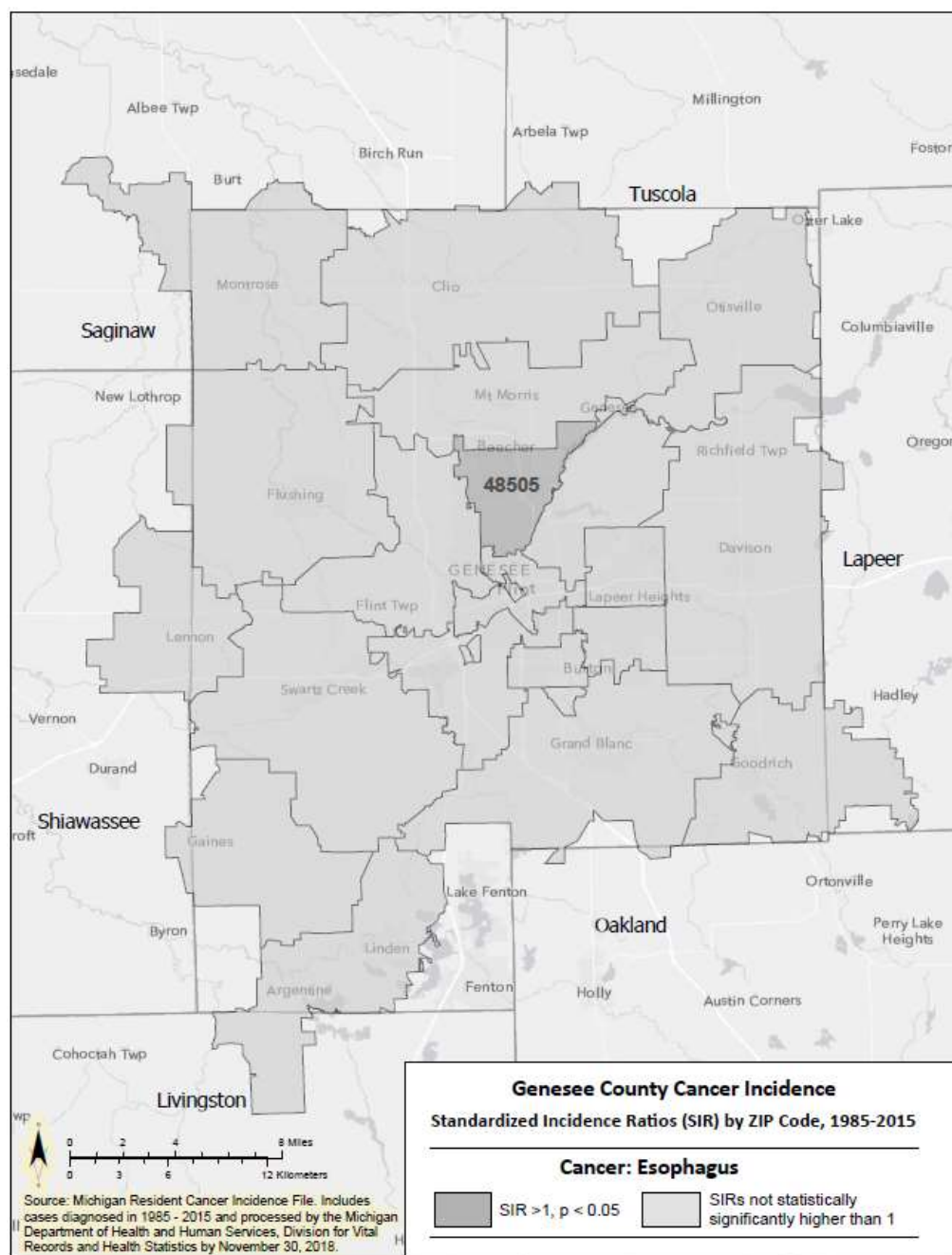


<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Corpus uteri & uterus not other specified cancer cases were defined by new malignant cancer diagnoses where the primary site was the corpus uteri or uterus not other specified in females.

**Figure 16. Standardized Incidence Ratio (SIR)<sup>1</sup> for Esophagus Cancer by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

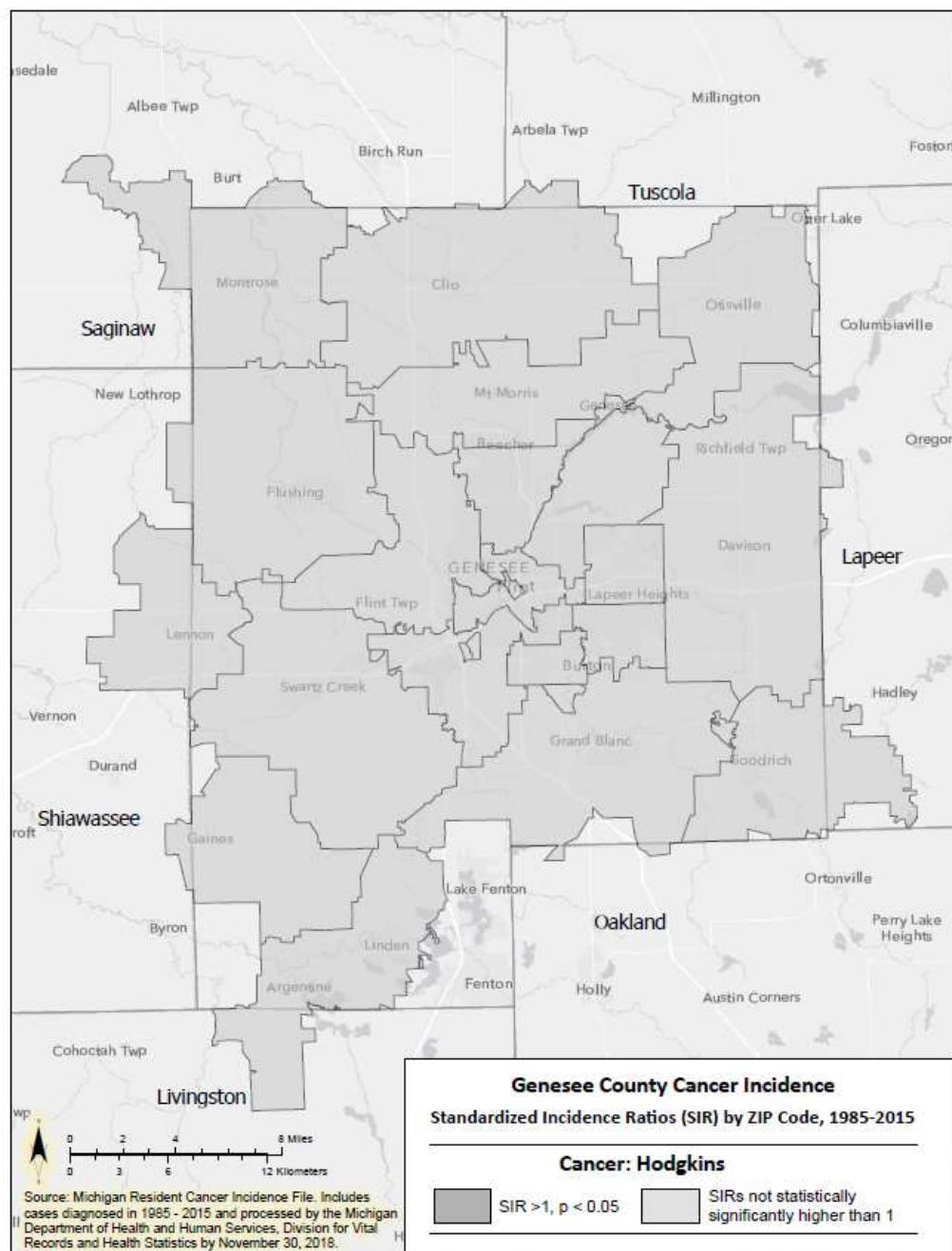


<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services. Esophagus cases were defined by new malignant cancer diagnoses where the primary site was the esophagus.



**Figure 17. Standardized Incidence Ratio (SIR)<sup>1</sup> for Hodgkin Lymphoma by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

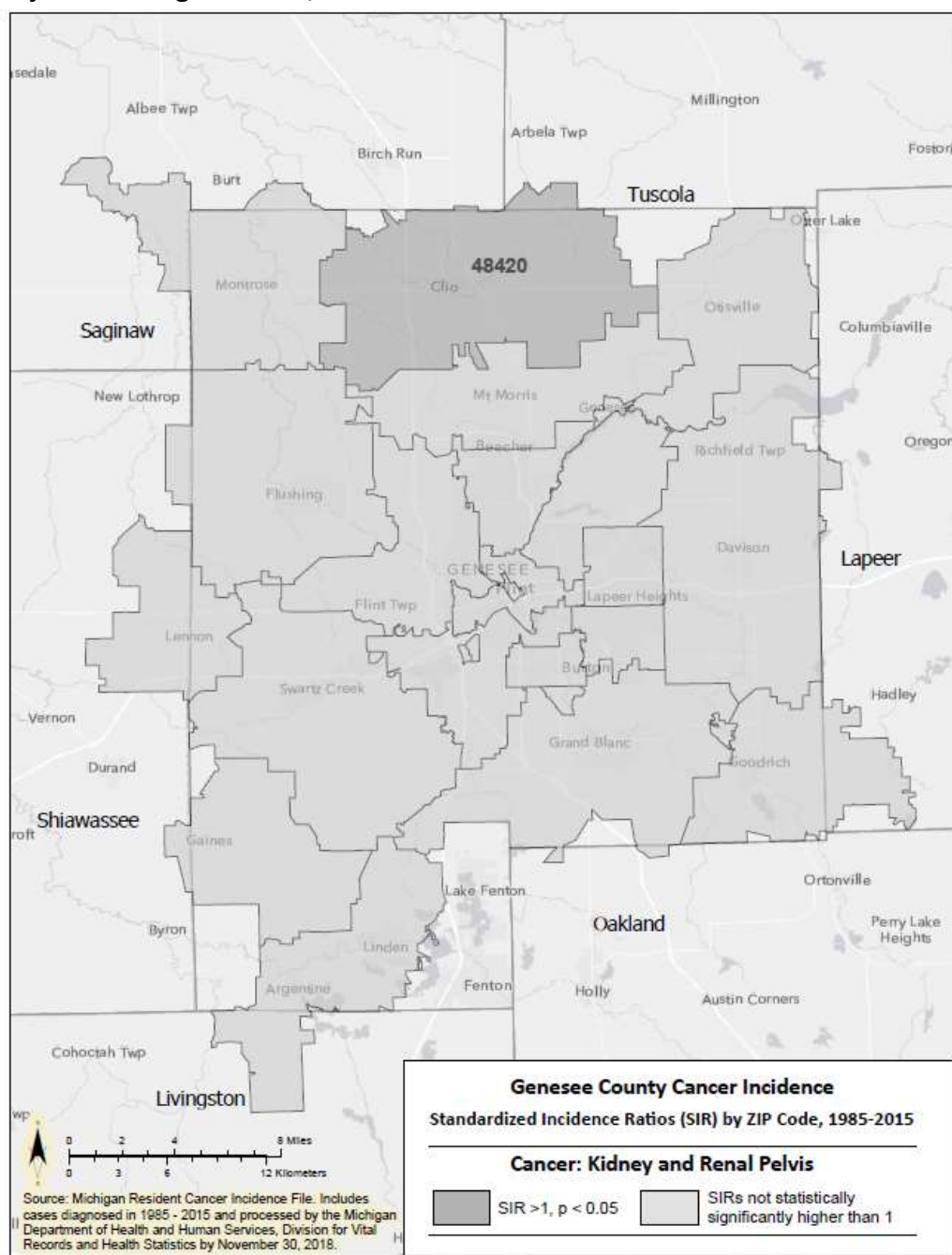


<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Hodgkin lymphoma cancer cases were defined by new malignant cancer diagnoses where the primary type was Hodgkin lymphoma.

**Figure 18. Standardized Incidence Ratio (SIR)<sup>1</sup> for Kidney and Renal Pelvis Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

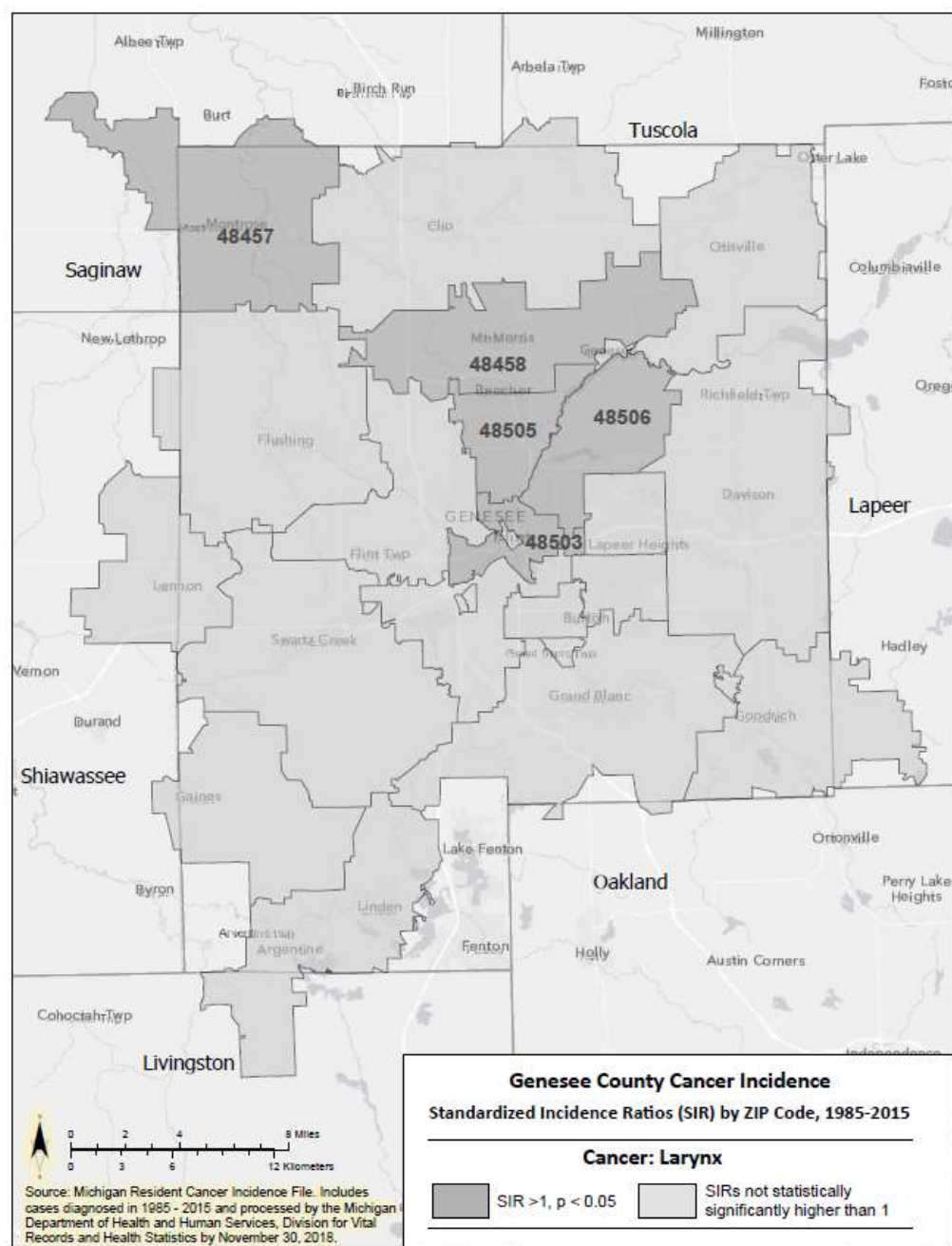


<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Kidney and renal pelvis cancer cases were defined by new malignant cancer diagnoses where the primary site was the kidney or renal pelvis.

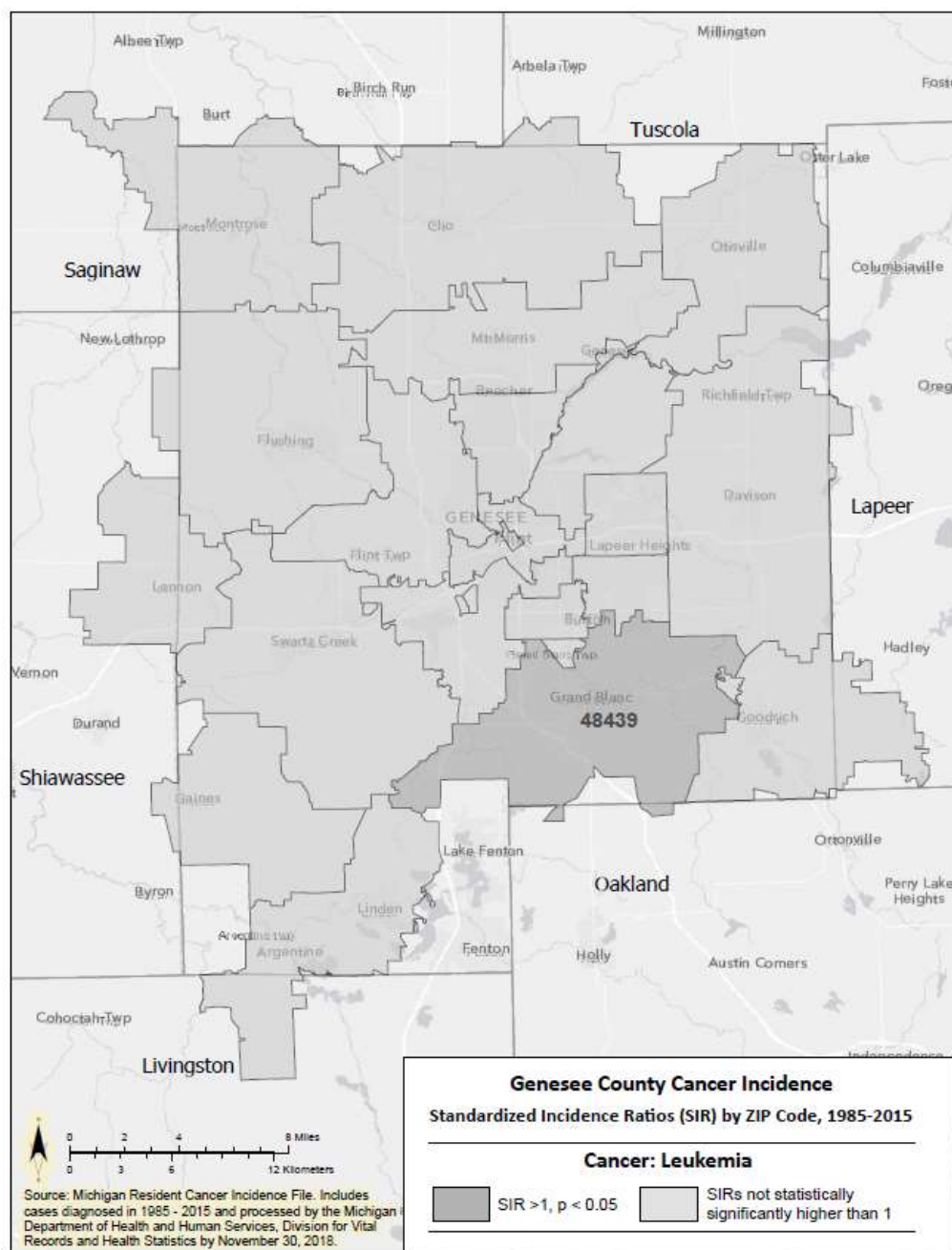
**Figure 19. Standardized Incidence Ratio (SIR)<sup>1</sup> for Larynx Cancer by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**



<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services. Larynx cancer cases were defined by new malignant cancer diagnoses where the primary site was the larynx.

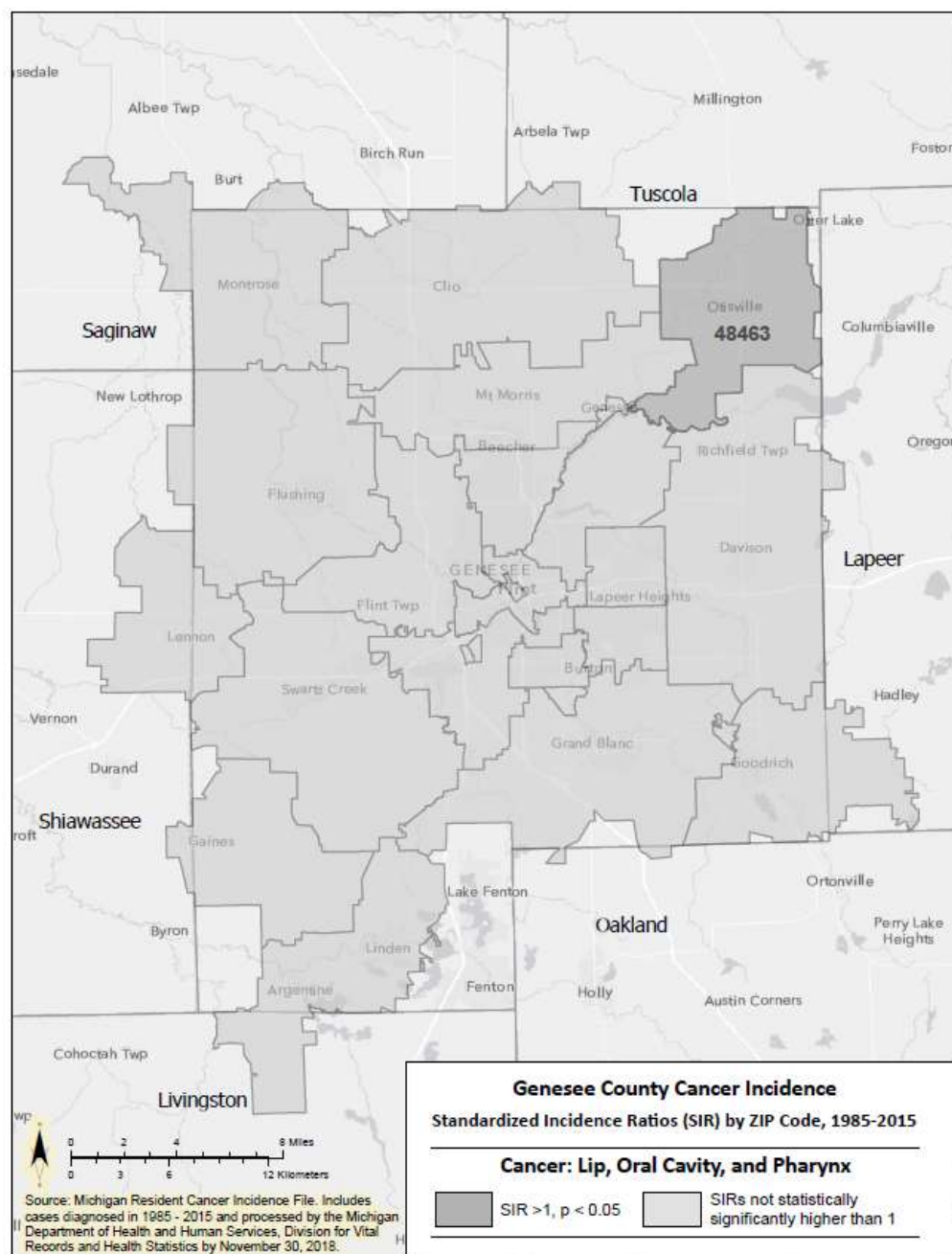
**Figure 20. Standardized Incidence Ratio (SIR)<sup>1</sup> for Leukemia by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**



<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services. Leukemia cancer cases were defined by new malignant cancer diagnoses where the primary type was leukemia.

**Figure 21. Standardized Incidence Ratio (SIR)<sup>1</sup> for Lip, Oral Cavity, and Pharynx Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**



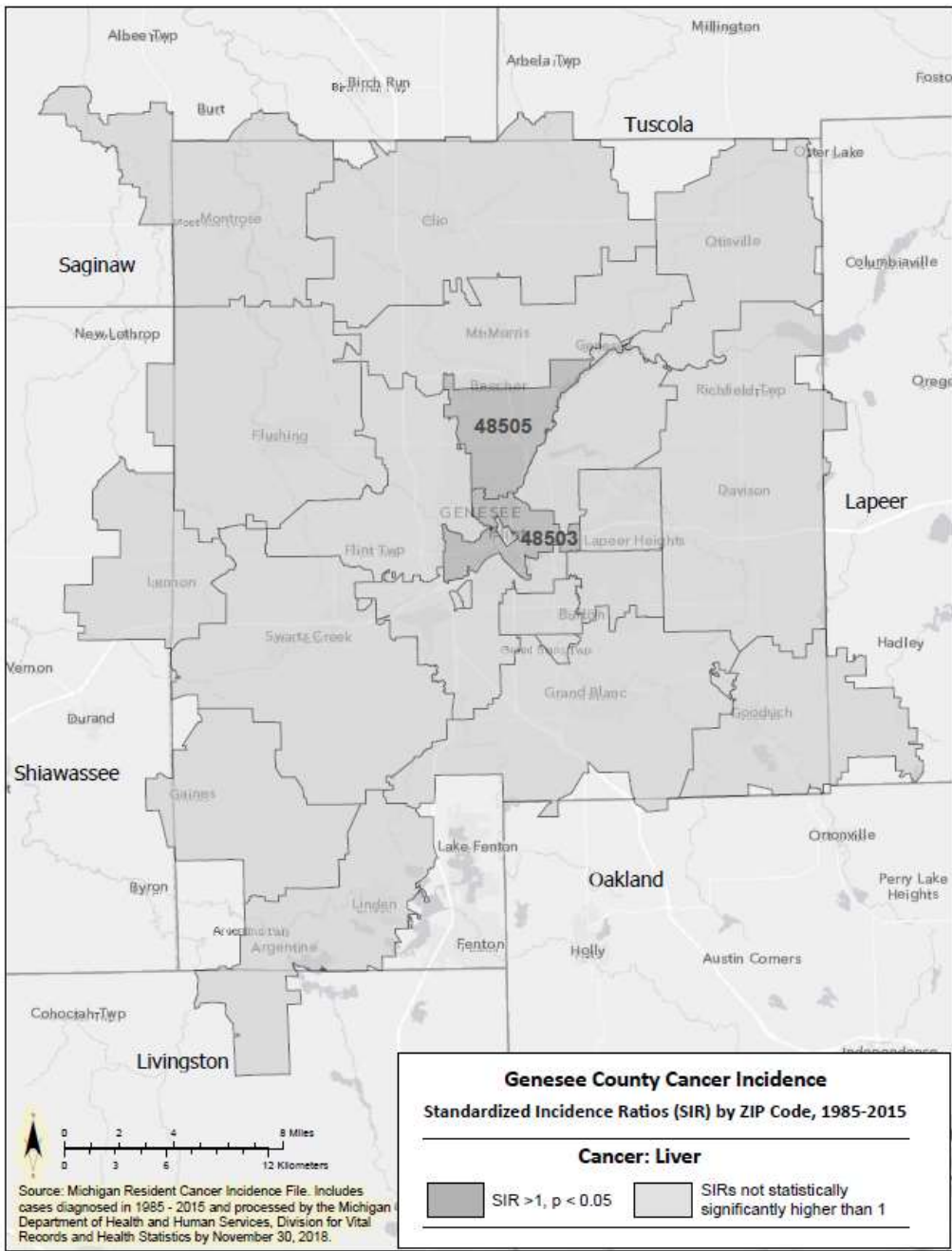
<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Lip, oral cavity, and pharynx cancer cases were defined by new malignant cancer diagnoses where the primary site was the lip, oral cavity, or pharynx.



**Figure 22. Standardized Incidence Ratio (SIR)<sup>1</sup> for Liver and Intrahepatic Bile Ducts Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

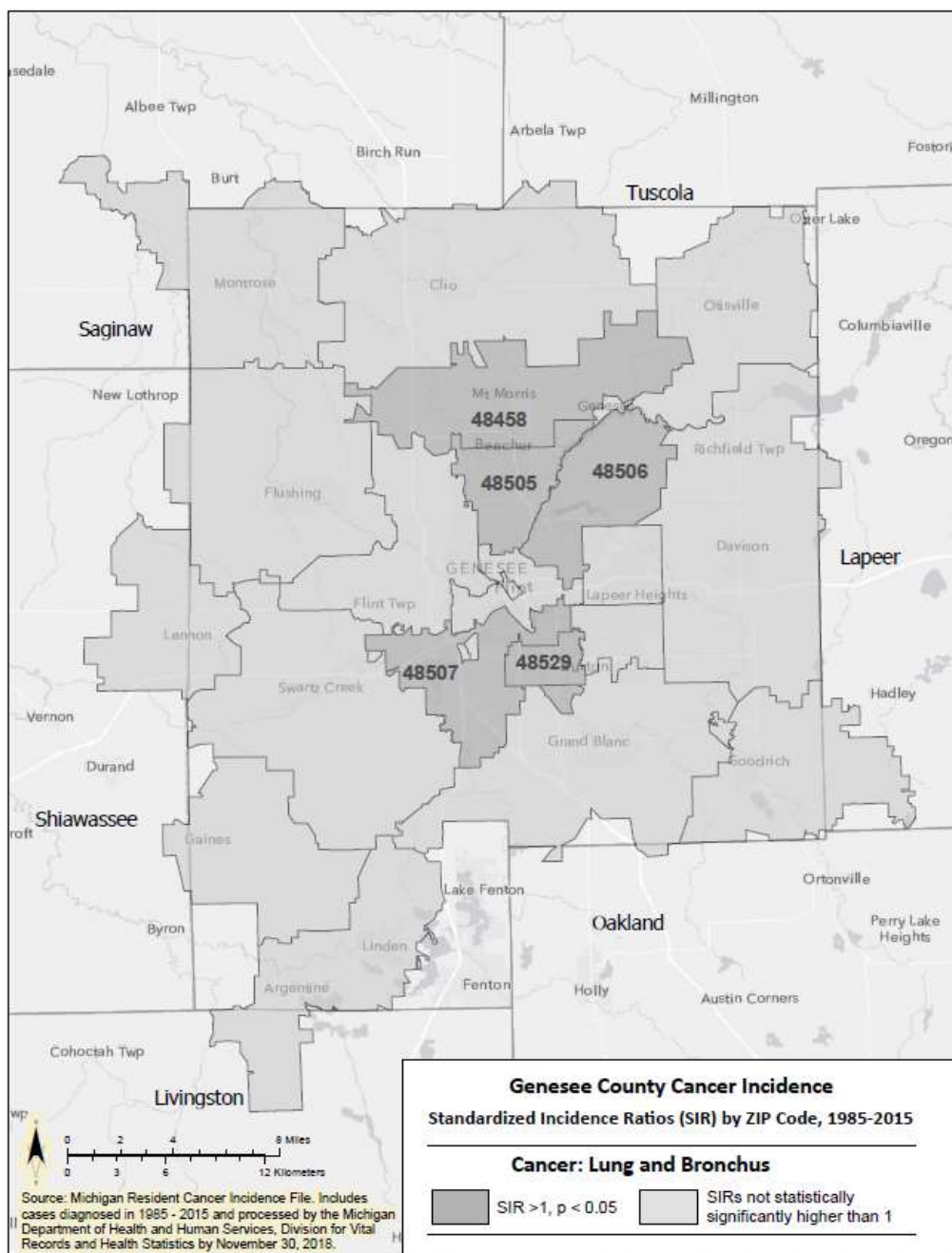


<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Liver and intrahepatic bile duct cancer cases were defined by new malignant cancer diagnoses where the primary site was the liver or intrahepatic bile duct.

**Figure 23. Standardized Incidence Ratio (SIR)<sup>1</sup> for Lung and Bronchus Cancers by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

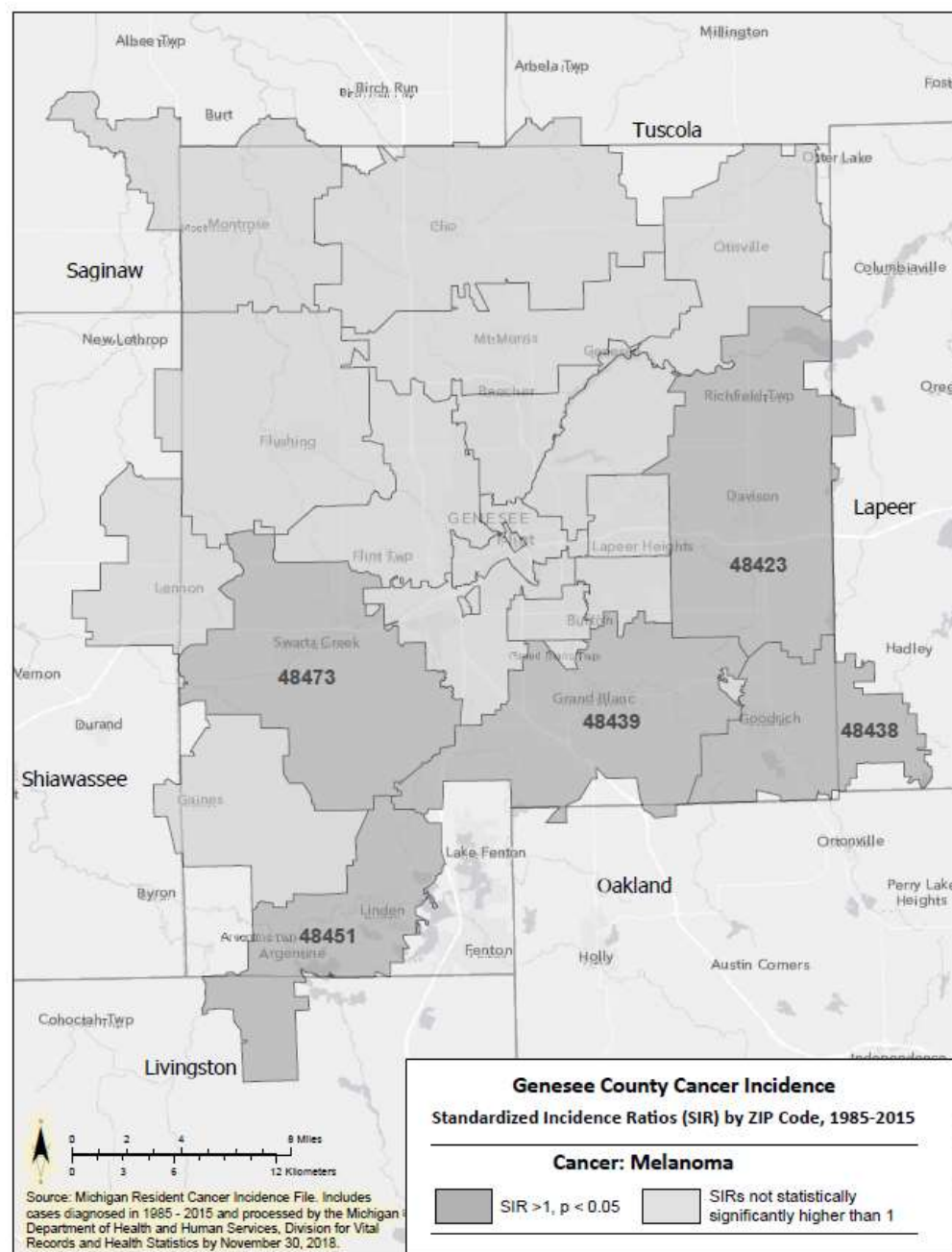


<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Lung and bronchus cancer cases were defined by new malignant cancer diagnoses where the primary site was the lung or bronchus.

**Figure 24. Standardized Incidence Ratio (SIR)<sup>1</sup> for Melanoma of the Skin by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**



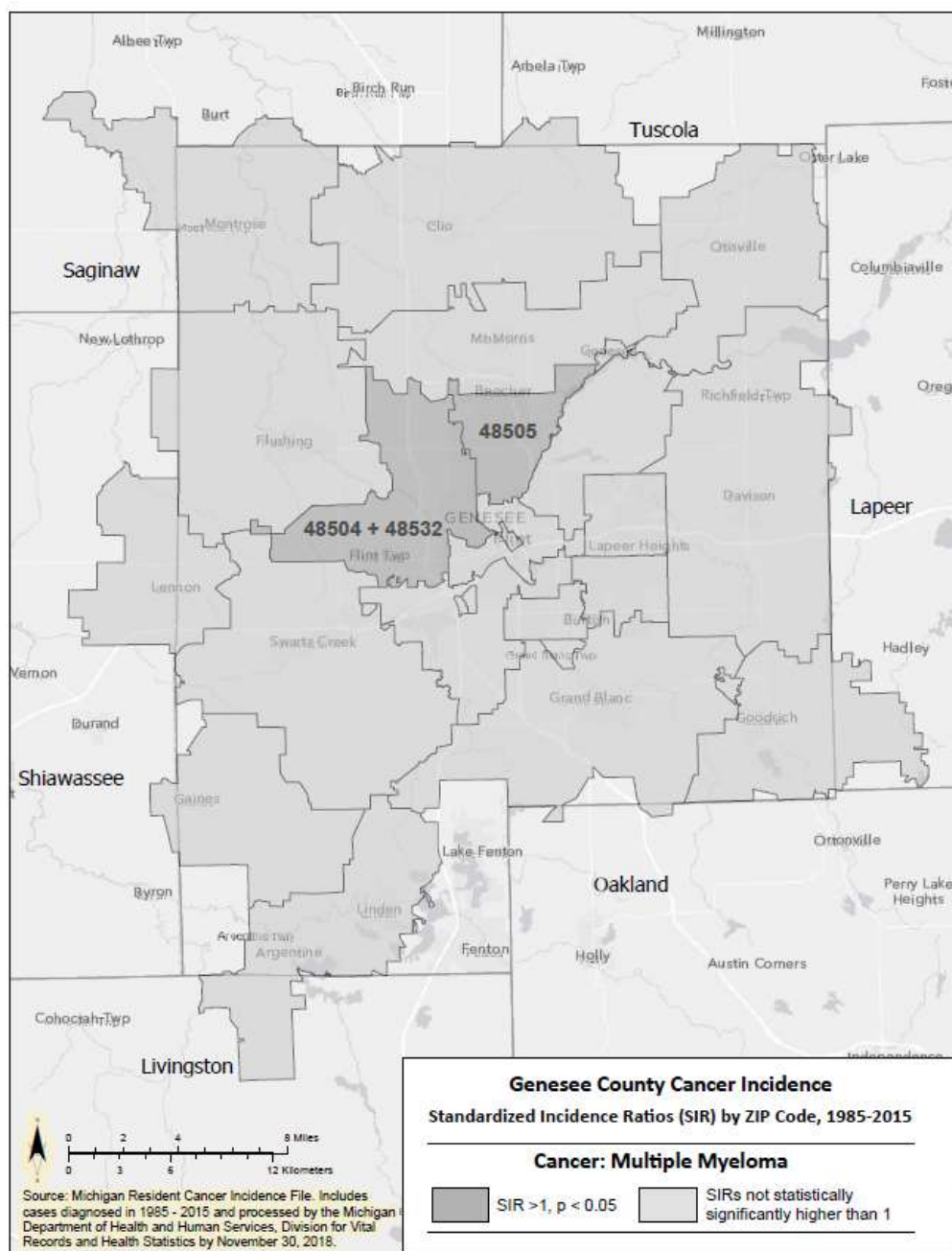
<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Melanoma of the skin cancer cases were defined by new malignant cancer diagnoses where the primary type was melanoma of the skin.



**Figure 25. Standardized Incidence Ratio (SIR)<sup>1</sup> for Multiple Myeloma by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

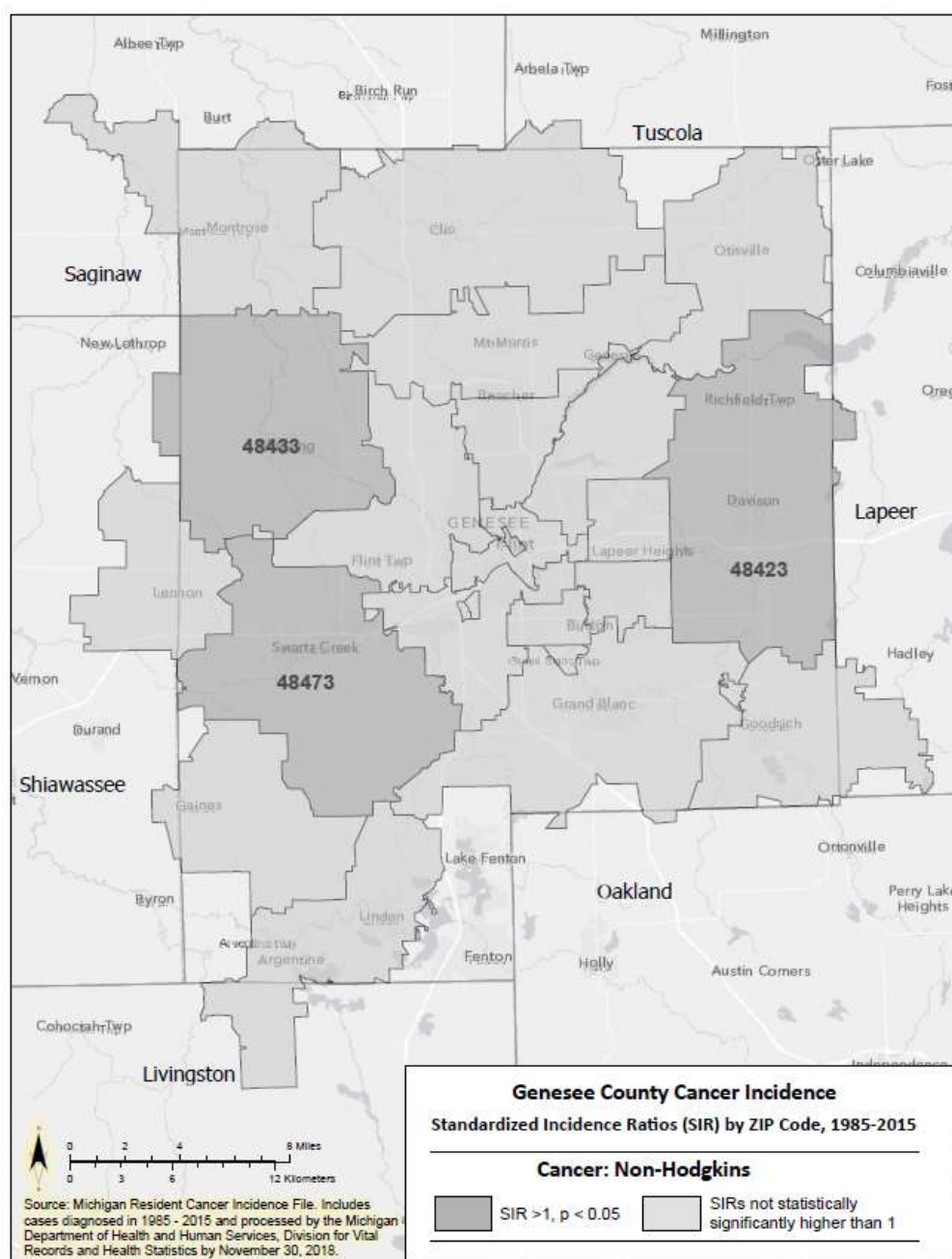


<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Multiple myeloma cancer cases were defined by new malignant cancer diagnoses where the primary type was multiple myeloma.

**Figure 26. Standardized Incidence Ratio (SIR)<sup>1</sup> for Non-Hodgkin Lymphoma by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

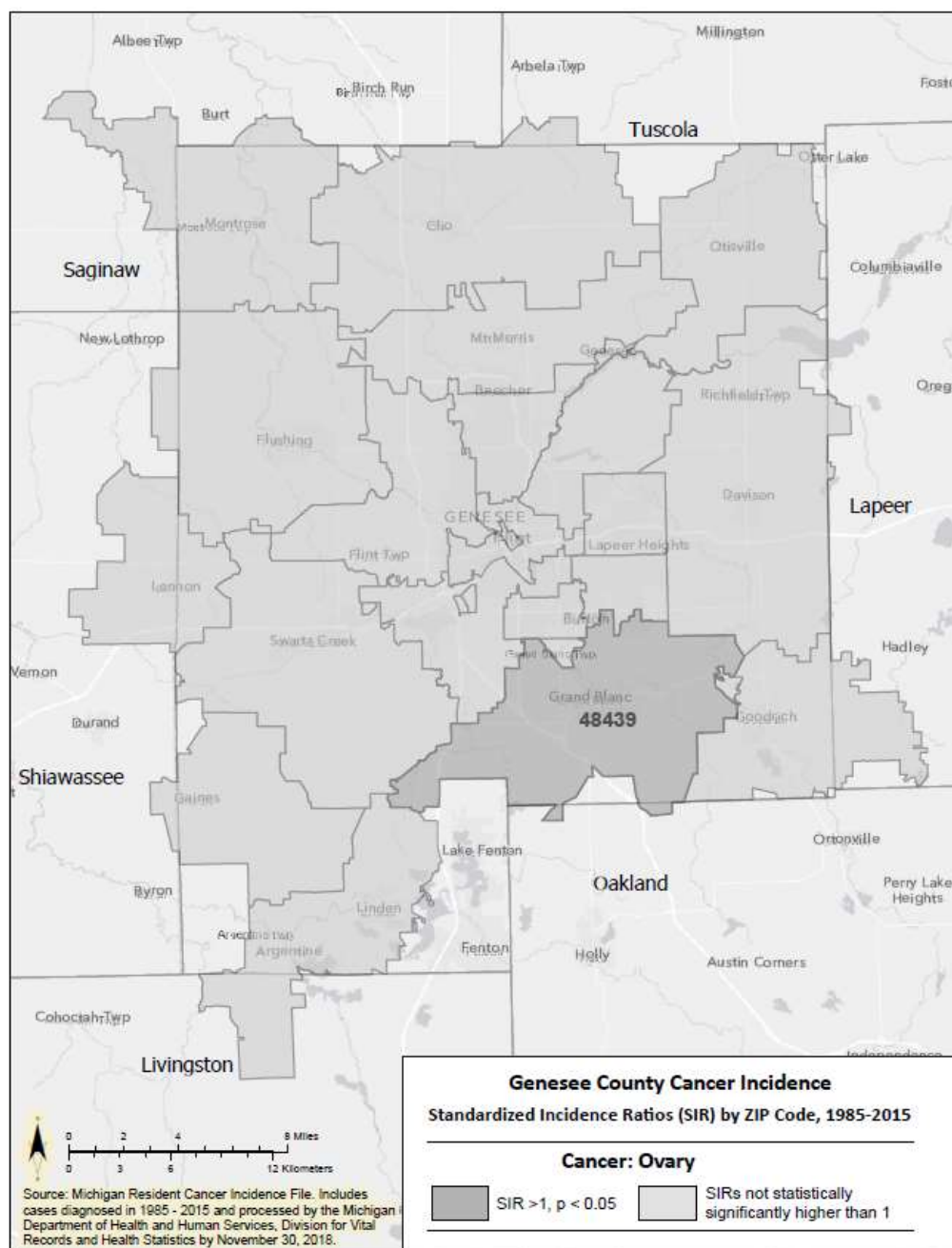


<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Non-Hodgkin lymphoma cancer cases were defined by new malignant cancer diagnoses where the primary type was non-Hodgkin lymphoma.

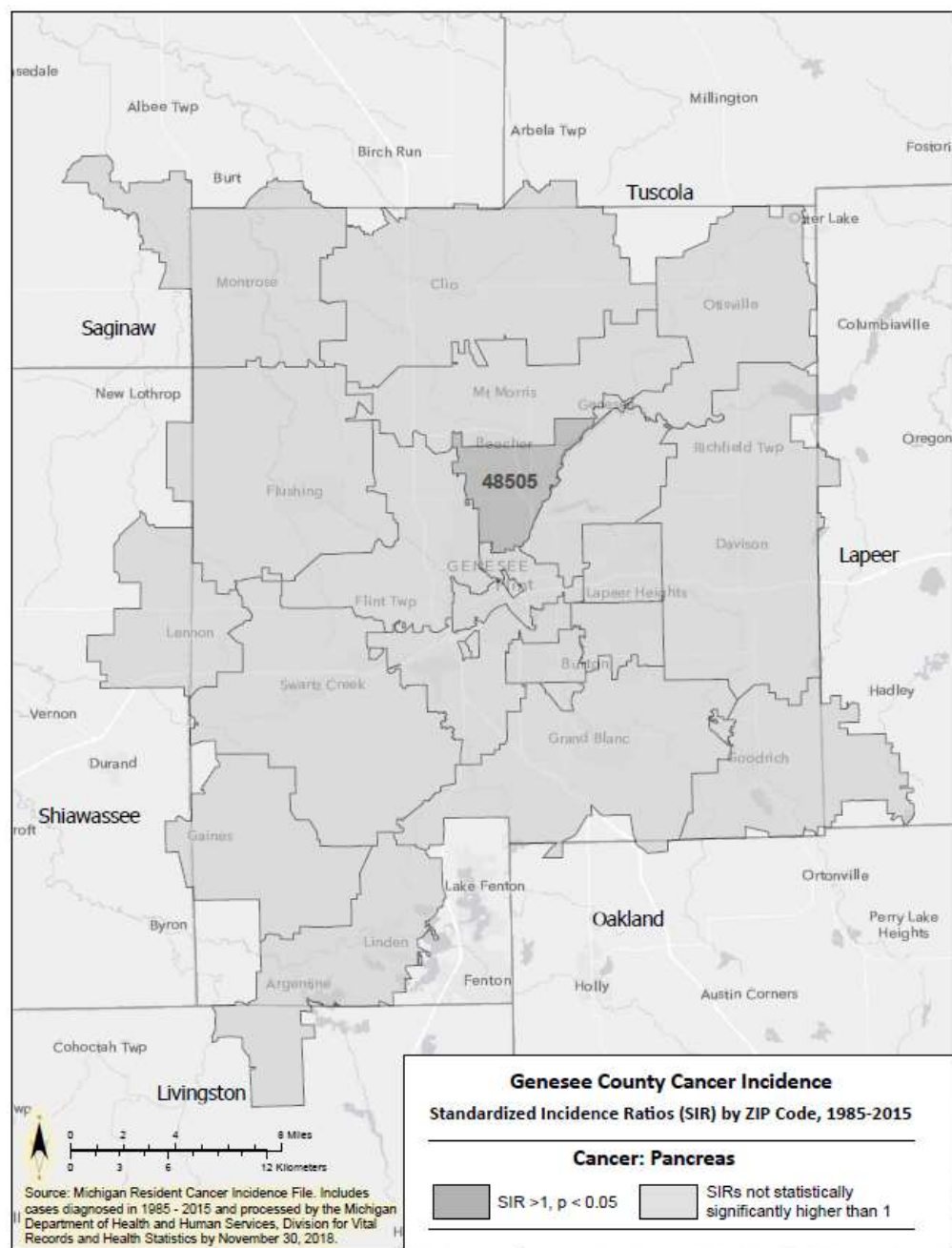
**Figure 27. Standardized Incidence Ratio (SIR)<sup>1</sup> for Ovarian Cancer in Females by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**



<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services. Ovarian cancer cases were defined by new malignant cancer diagnoses where the primary site the ovaries in females.

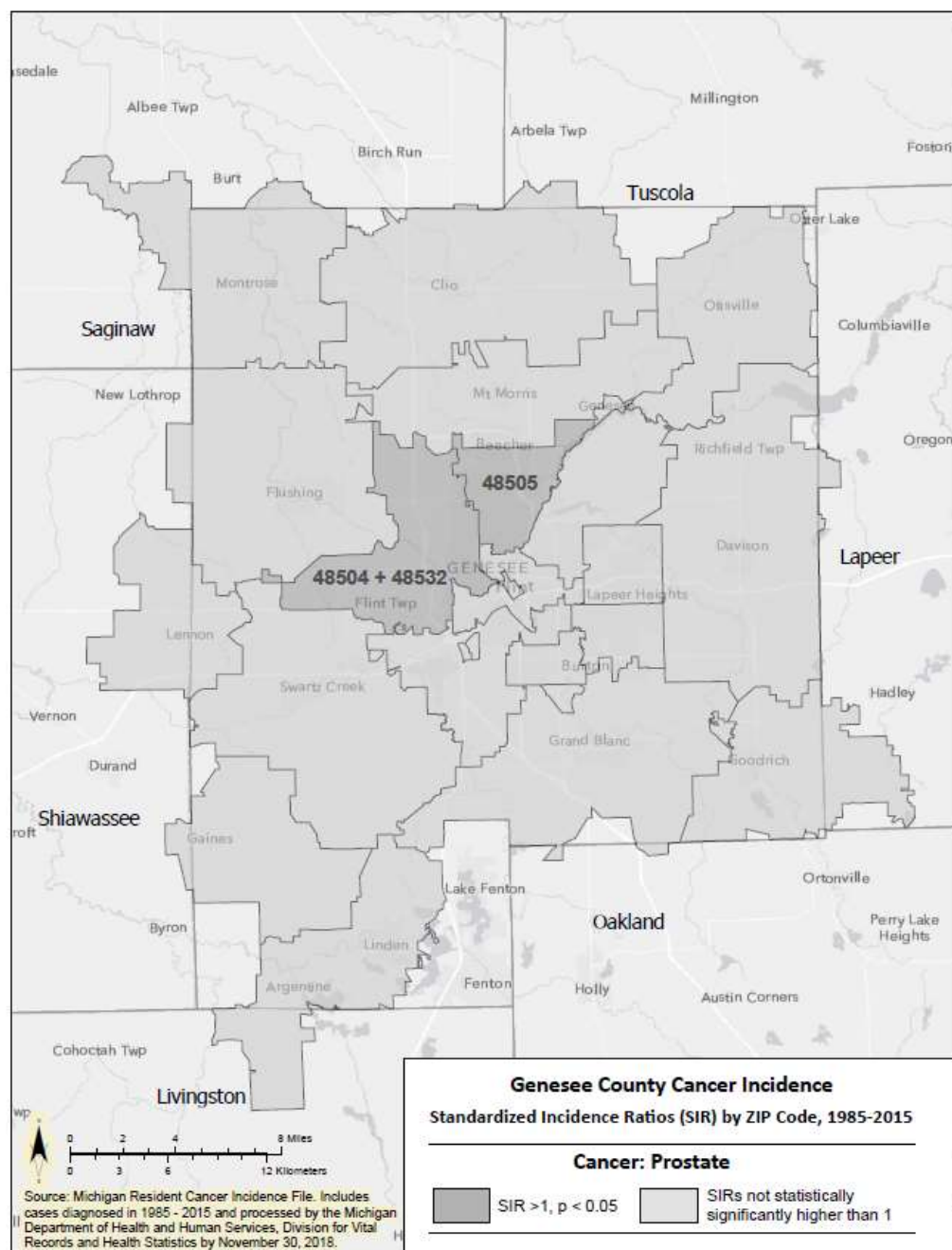
**Figure 28. Standardized Incidence Ratio (SIR)<sup>1</sup> for Pancreas Cancer by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**



<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services. Pancreas cancer cases were defined by new malignant cancer diagnoses where the primary site was the pancreas.

**Figure 29. Standardized Incidence Ratio (SIR)<sup>1</sup> for Prostate Cancer in Males by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**



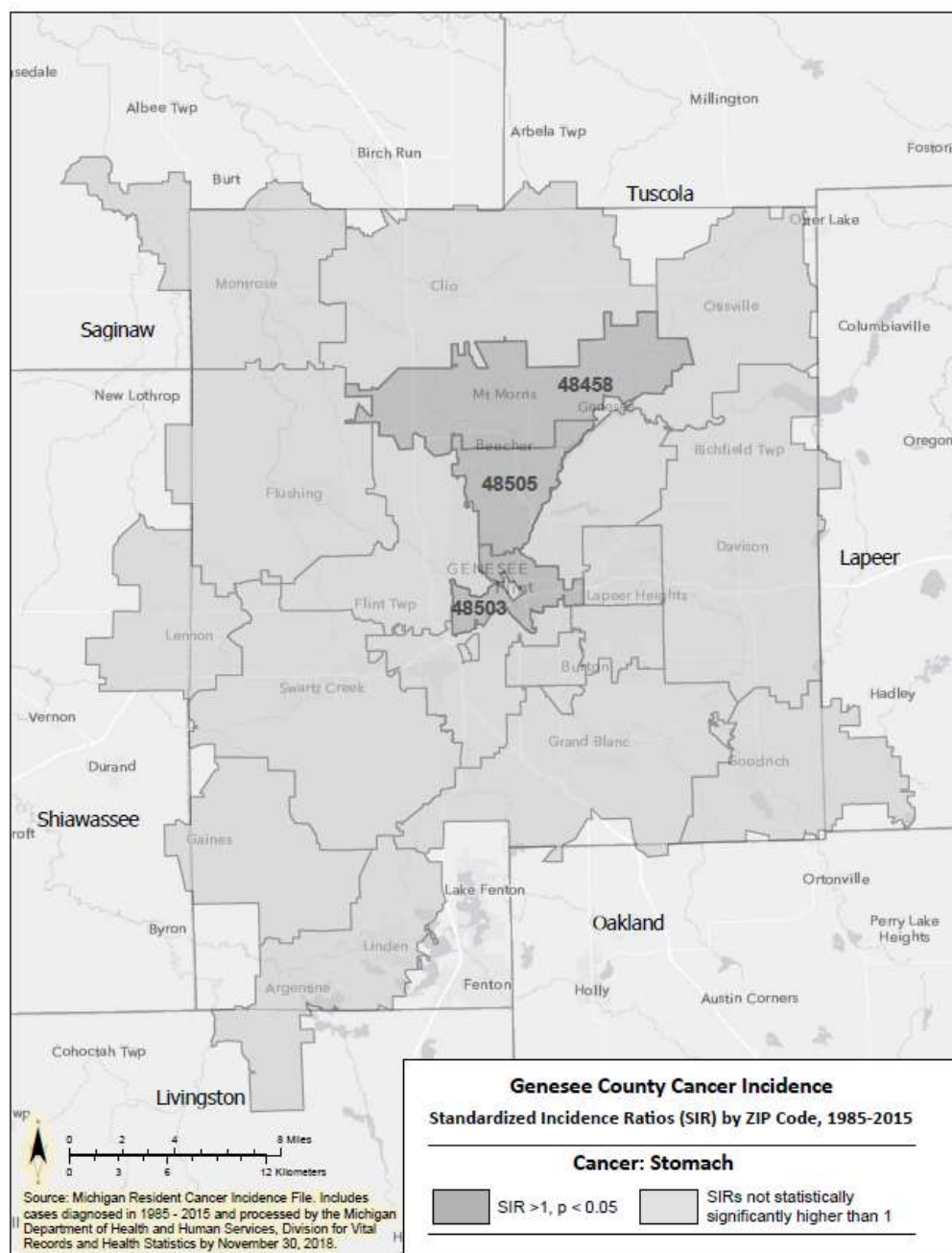
<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Prostate cancer cases were defined by new malignant cancer diagnoses where the primary site was the prostate in males.



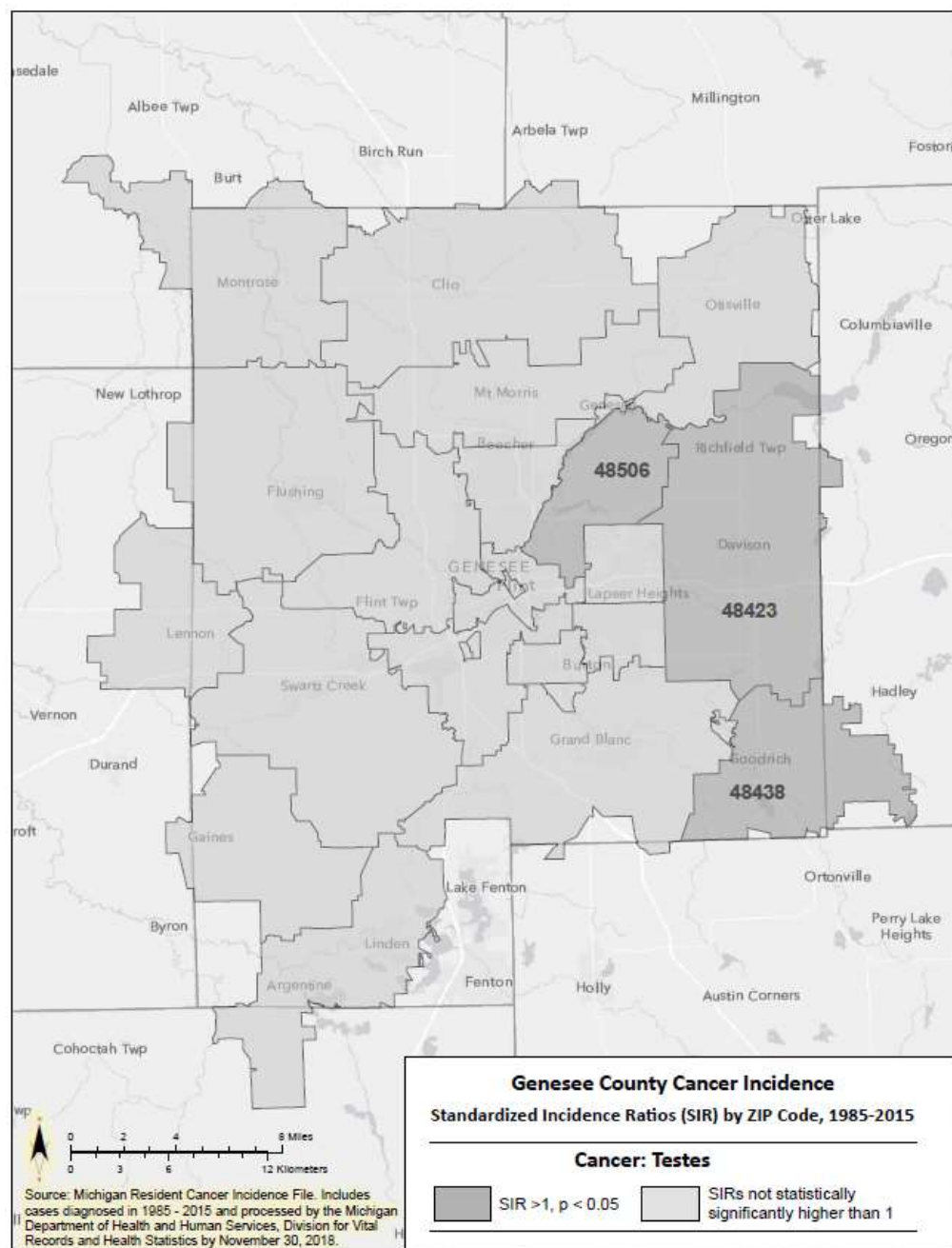
**Figure 30. Standardized Incidence Ratio (SIR)<sup>1</sup> for Stomach Cancer by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**



<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services. Stomach cancer cases were defined by new malignant cancer diagnoses where the primary site was the stomach.

**Figure 31. Standardized Incidence Ratio (SIR)<sup>1</sup> for Testicular Cancer in Males by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

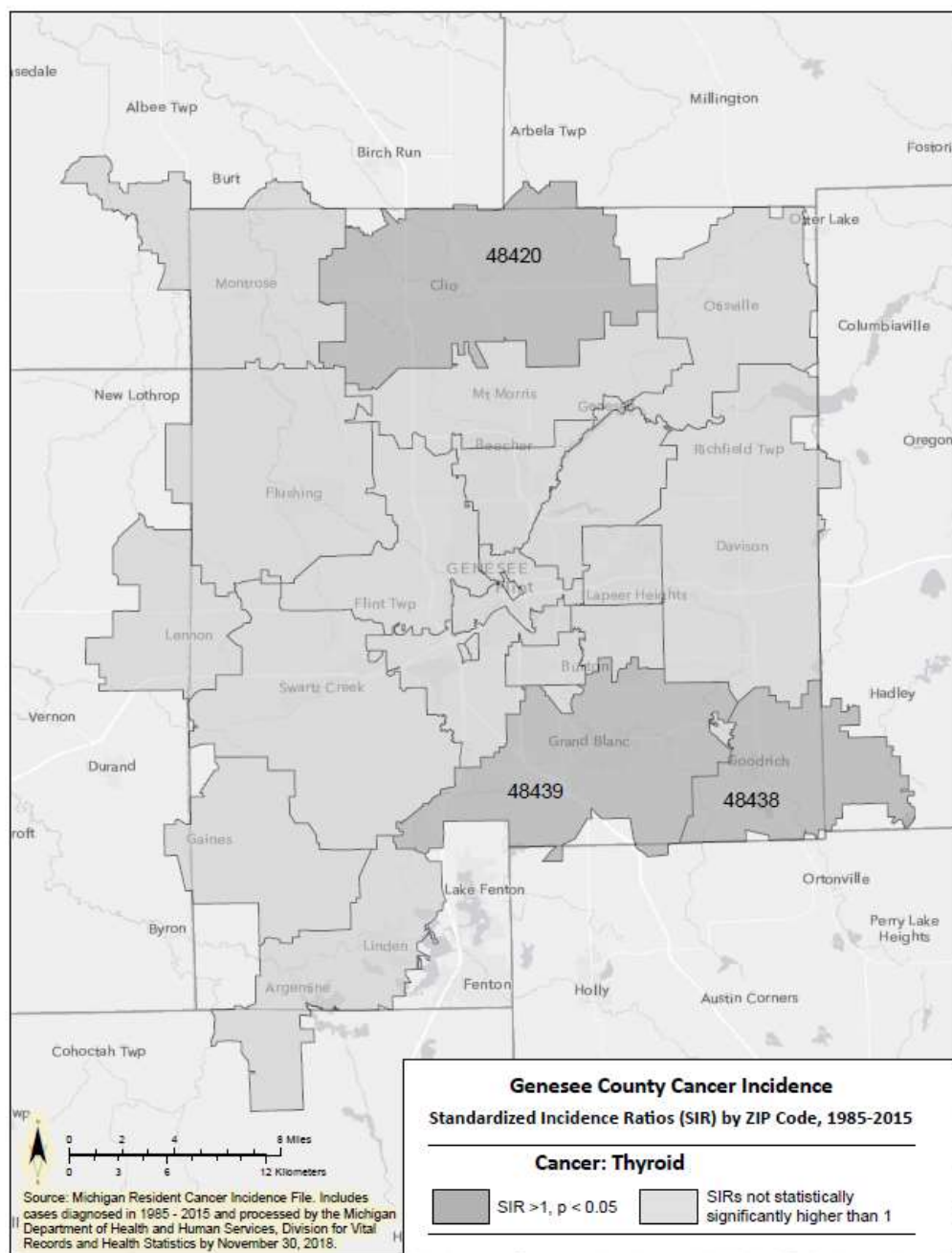


<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Testicular cancer cases were defined by new malignant cancer diagnoses where the primary site was the testis in males.

**Figure 32. Standardized Incidence Ratio (SIR)<sup>1</sup> for Thyroid Gland Cancer by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**



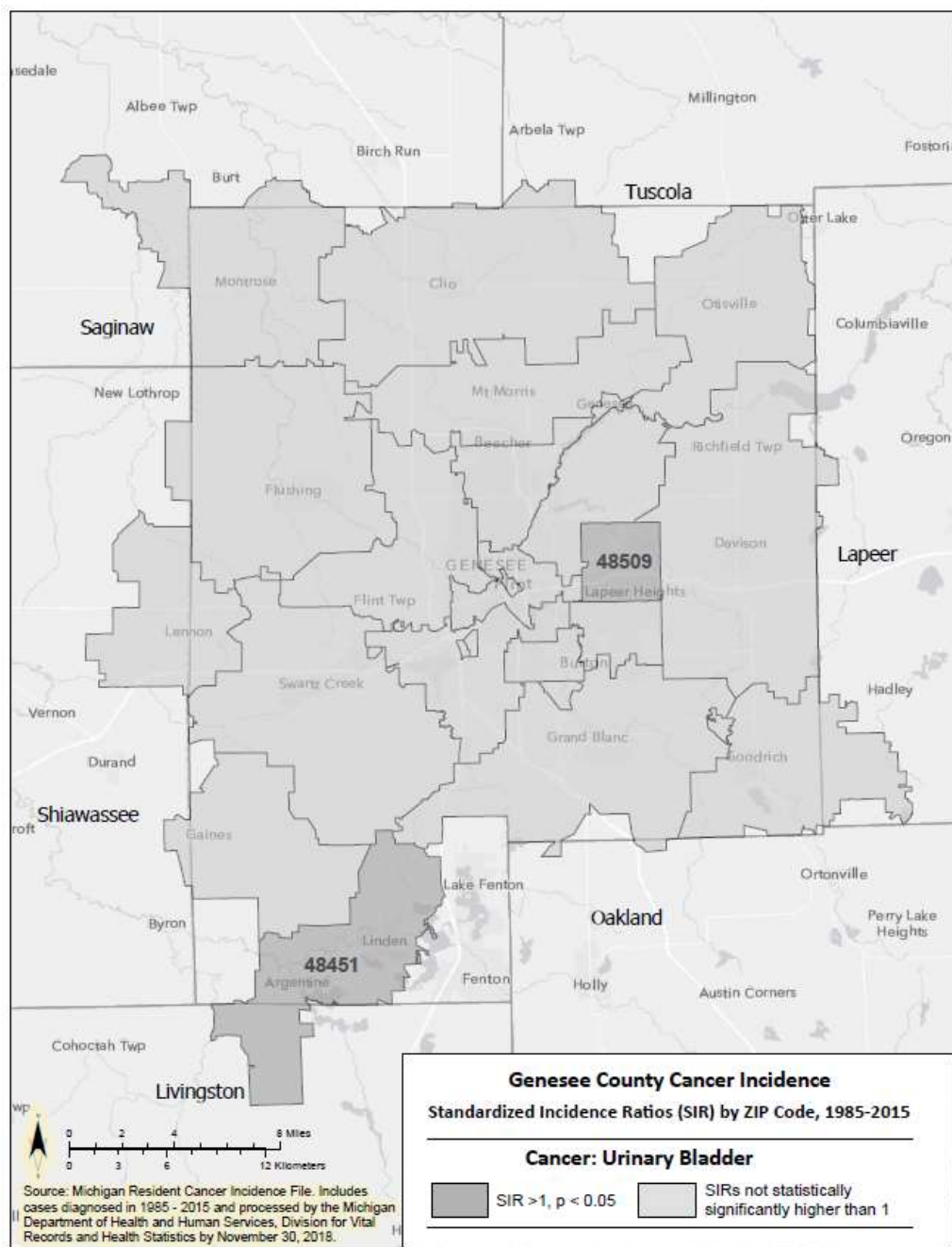
<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Thyroid cancer cases were defined by new malignant cancer diagnoses where the primary site was the thyroid gland.



**Figure 33. Standardized Incidence Ratio (SIR)<sup>1</sup> for Urinary Bladder Cancer by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**

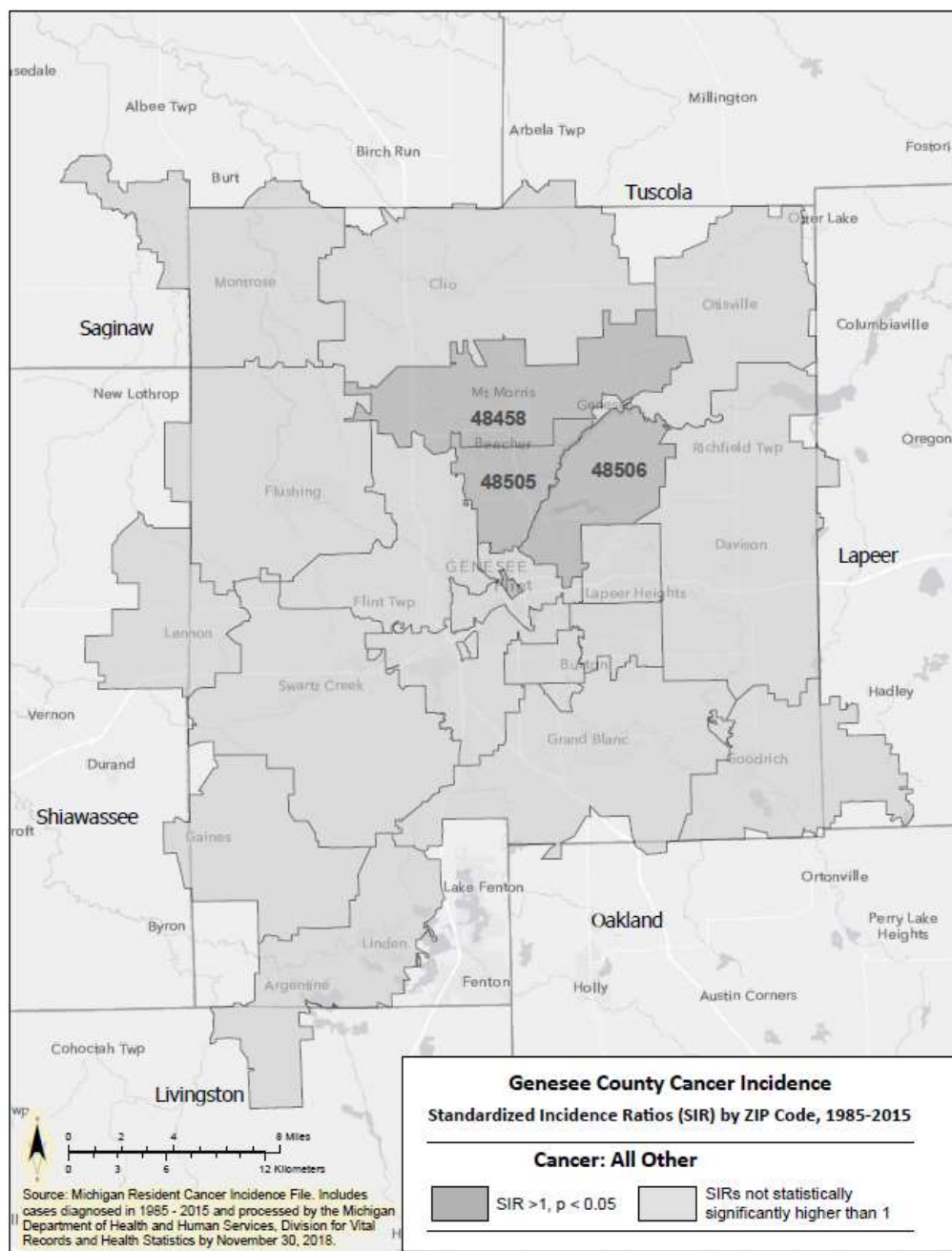


<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

Urinary bladder cancer cases were defined by new malignant cancer diagnoses where the primary site was the urinary bladder.

**Figure 34. Standardized Incidence Ratio (SIR)<sup>1</sup> for All Other Cancer Types Combined by ZIP Code of Residence, Adjusted for Age and Sex, 1985 – 2015<sup>2</sup>**



<sup>1</sup>SIR is the ratio of observed to expected cases, where expected cases are calculated by multiplying the age-sex specific cancer incidence rates for Genesee County to ZIP code population estimates. The ZIP code population for 1990 was used for 1989 – 1992 rates, 1994 was used for 1993 – 1998 rates, 2000 was used for 1999 – 2006 rates, and 2010 was used for 2007 – 2015 rates.

<sup>2</sup>Source of Michigan Cancer Cases: Michigan Resident Cancer Incidence File, 1985 – 2015, includes cases processed through November 30, 2017. Division for Vital Records & Health Statistics, Michigan Department of Health and Human Services.

All other types of cancer cases were defined by new malignant cancer diagnoses where the primary site was not one of those identified individually.