Geographic Distribution of Select Hereditary Cancers and Cancer Genetic Services in Michigan, 2013-2017

Overview

Background

Harmful mutations in the BReast CAncer, or *BRCA1* and *BRCA2* genes, substantially increase the risk of developing hereditary breast and ovarian cancers (HBOC) over the course of a lifetime. Additionally, a *BRCA1* or *BRCA2* mutation, the most common causes of HBOC, increases the risk for pancreatic and prostate cancers.

Variations in *MLH1*, *MSH2*, *MSH6*, *PMS2,* or *EPCAM* genes increase the risk of developing Lynch syndrome (LS). LS is an inherited disorder that increases the risk of colorectal, endometrial, ovarian and other cancers. Genetic counseling with a board certified and/or eligible genetics provider, followed by genetic testing as appropriate, are the recommended first steps for anyone with a personal history or strong family history of these cancers.

Early identification of HBOC or LS can help reduce the impact of cancer and save the lives of family members who may also be at risk. It is important to analyze the geographic distribution of cancers that may be associated with HBOC or LS and genetic counseling. Identifying areas that are high in need for genetic counseling but are low in genetic counseling usage helps drive program planning decisions. This brief uses the Michigan Cancer Surveillance Program (MCSP) to identify areas of high need for genetic counseling based on incidence rates of specific cancers.

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Data and Methods

Population

The cancers outlined in this report have been identified as cancers most likely to have an underlying genetic predisposition due to hereditary breast or ovarian cancer (HBOC) and Lynch syndrome (LS). These cancers include breast, ovarian, colorectal, endometrial, prostate and pancreatic cancers.

Cancer Incidence

Data on the incidence rates of specific cancers are provided by the MCSP and include cases diagnosed in 2013-2017. These rates are age-adjusted by the direct method to the 2000 U.S. standard population. The cancers outlined in this report have been identified as cancers most likely to have an underlying genetic predisposition due to HBOC and LS.

Cancer Genetic Services

The number of patients receiving genetic counseling in Michigan is from the BRCA Clinical Network and Hereditary Cancer Network (HCN) Databases. Twenty-one clinics have contributed information to this database.[a] This database only contains information on patients who present at a clinic participating in the HCN and therefore may not be representative of all genetic counseling performed in the state. Patients who present at one of these clinics seeking HBOC or LS counseling are included for the years 2013-2017 (N=18,278).

Outliers

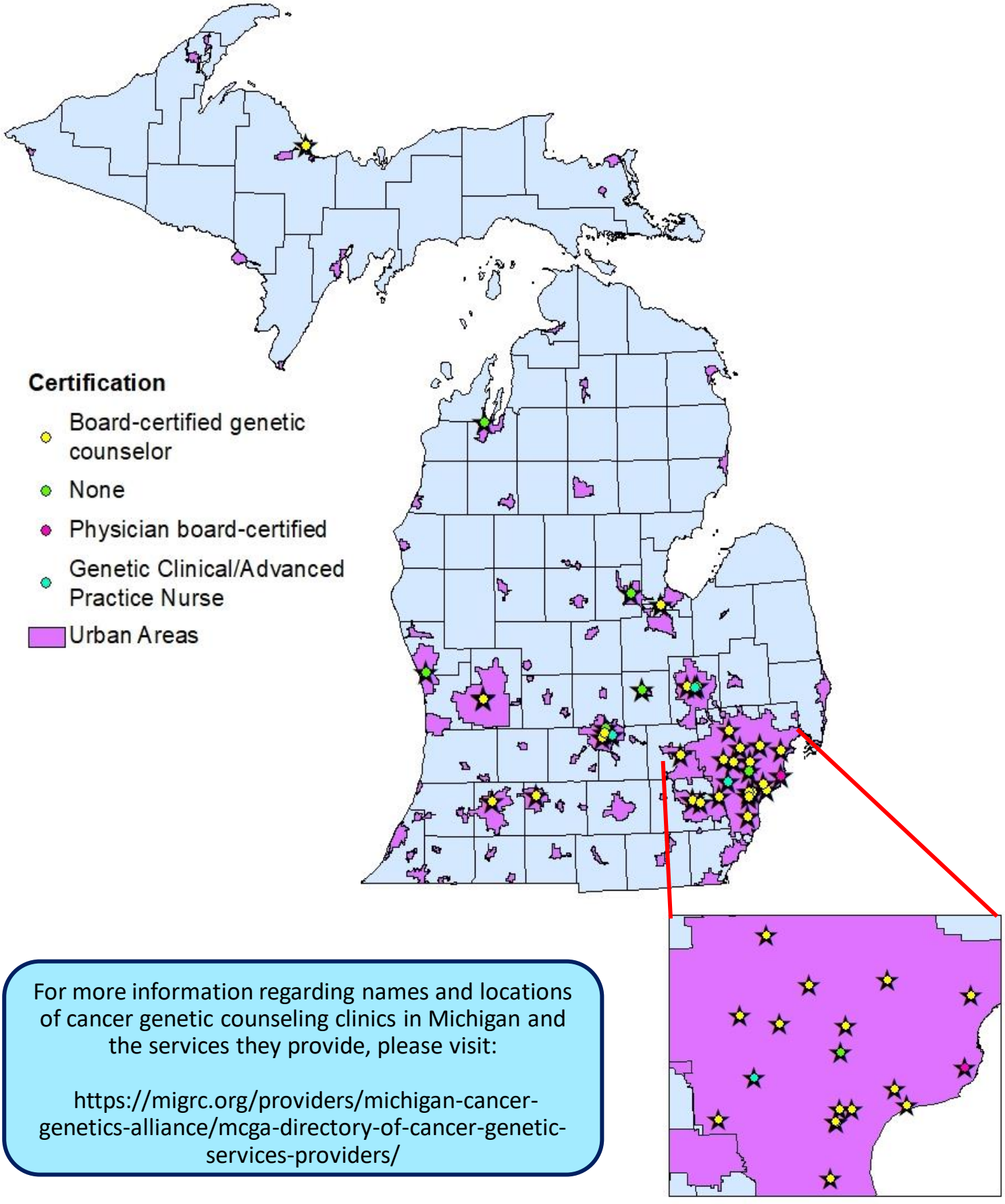
In this report, outliers refer to counties with an abnormally high incidence rate. Counties are considered outliers if the incidence rate is greater than the outlier cutoff of Q3 + (IQR*1.5), where Q3 refers to the third quartile, and IQR refers to the interquartile range (Q3-Q1). These counties are outlined in red in the maps.

Data Suppression Rules

Numbers are suppressed for incidence rates for counties with age-adjusted numerators less than 20 or for age-specific numerators less than six. Data suppression rules are noted in each figure in which it applies to. Numbers are suppressed for cancer genetic service data when counts are less than six. Data suppression rules are noted in each figure in which it applies to.

[a] Beaumont Cancer Genetics Program, Beaumont Center for Hematology and Oncology, Henry Ford Health System Cancer Genetics Program, Karmanos Cancer Institute Cancer Genetic Counseling Service, Informed DNA Telephone Genetic Counseling Services, Mid-Michigan Hereditary Cancer Clinic, Michigan State University Hereditary Cancer Program, Marquette General Hematology/Oncology, Munson Cancer Genetics Clinic, Sparrow Cancer Center, Spectrum Health Cancer Genetics Program, St. Joseph Mercy Hospital Cancer Genetics Program, St. John Providence Health System Cancer Genetics Program (Southfield and Grosse Pointe Woods, MI), St. Mary Health Care Lacks Cancer Center Genetics (Grand Rapids, MI), St. Mary Mercy Our Lady of Hope Cancer Center (Livonia, MI), University of Michigan Breast and Ovarian Cancer Risk and Evaluation Program, University of Michigan Cancer Genetics Clinic, West Michigan Cancer Center.

Locations of Cancer Genetic Services in Michigan, 2013-2017

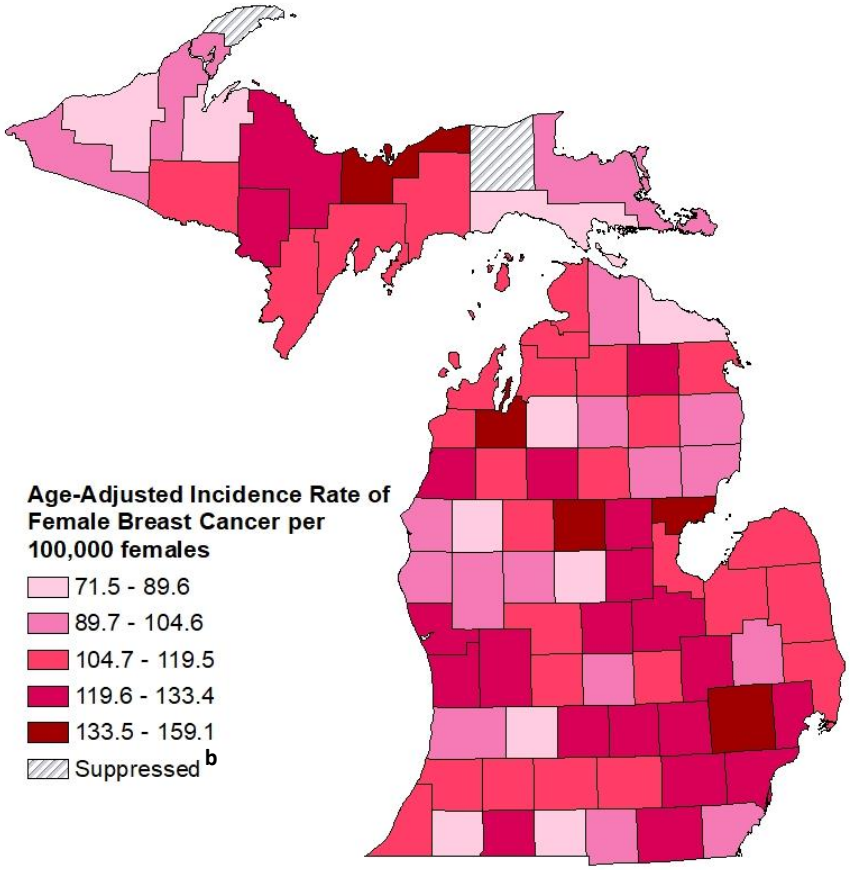


For more information regarding names and locations of cancer genetic counseling clinics in Michigan and the services they provide, please visit:

https://migrc.org/providers/michigan-cancer-genetics-alliance/mcga-directory-of-cancer-genetic-services-providers/

Female Breast Cancer Diagnosed in Michigan, 2013-2017

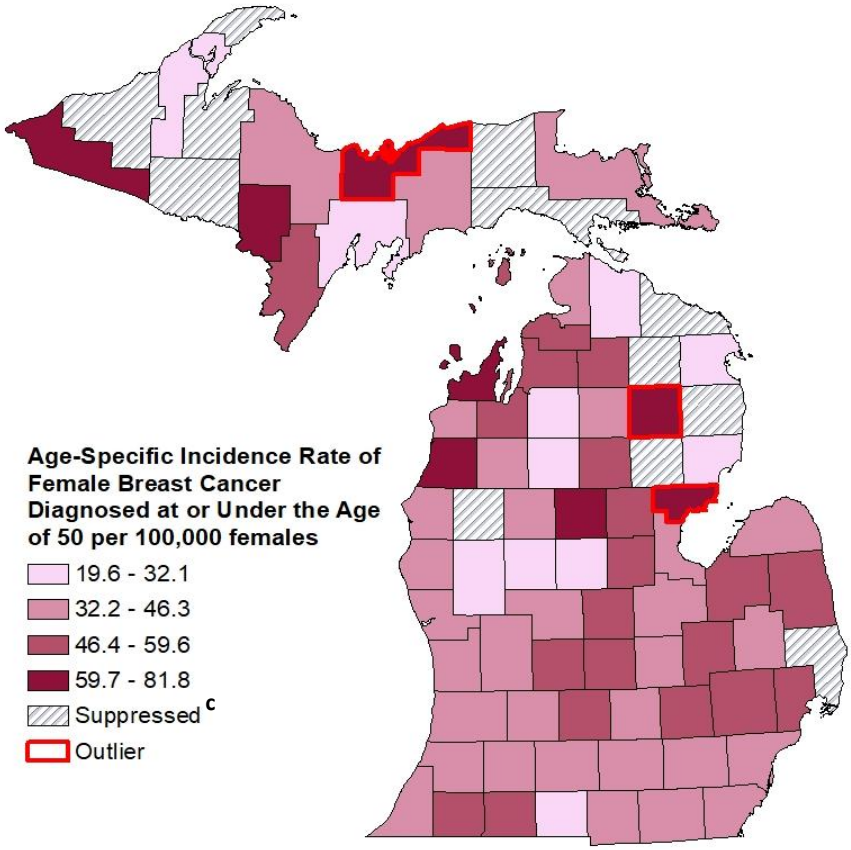
- In the general population, the risk of breast cancer is 13%.[1]
  - A *BRCA1* mutation increases the risk to 40%-87%.[2]
  - A *BRCA2* mutation increases the risk to 27%-84%.[2]
- About 10% of breast cancer is considered heritable.[3]
- The age-adjusted incidence for female breast cancer in Michigan during this timeframe is 122.2 per 100,000 females.
- There were no counties in Michigan that were considered outliers for female breast cancer.
- Among patients in the BRCA & HCN databases from 2013 to 2017, 42.8% were diagnosed with breast cancer.



Data Source: Michigan Department of Health and Human Services (MDHHS) Michigan Cancer Surveillance Program (MCSP), 2013-2017

Young Female Breast Cancer (≤50 years old) Diagnosed in Michigan, 2013-2017

- Only 5% of breast cancers are diagnosed in young women, however a higher proportion of patients carry a pathogenic variant of *BRCA1* and *BRCA2* compared to those diagnosed at an older age.[4]
- The age-adjusted incidence rate for young female breast cancer in Michigan during this timeframe is 45.7 per 100,000 females.
- There were three counties in Michigan that had incidence rates for young breast cancer that were considered outliers:
  - Alger
  - Arenac
  - Oscoda
- Of those with breast cancer in the BRCA & HCN databases from 2013 to 2017, 49.6% were diagnosed with breast cancer at age 50 or younger.

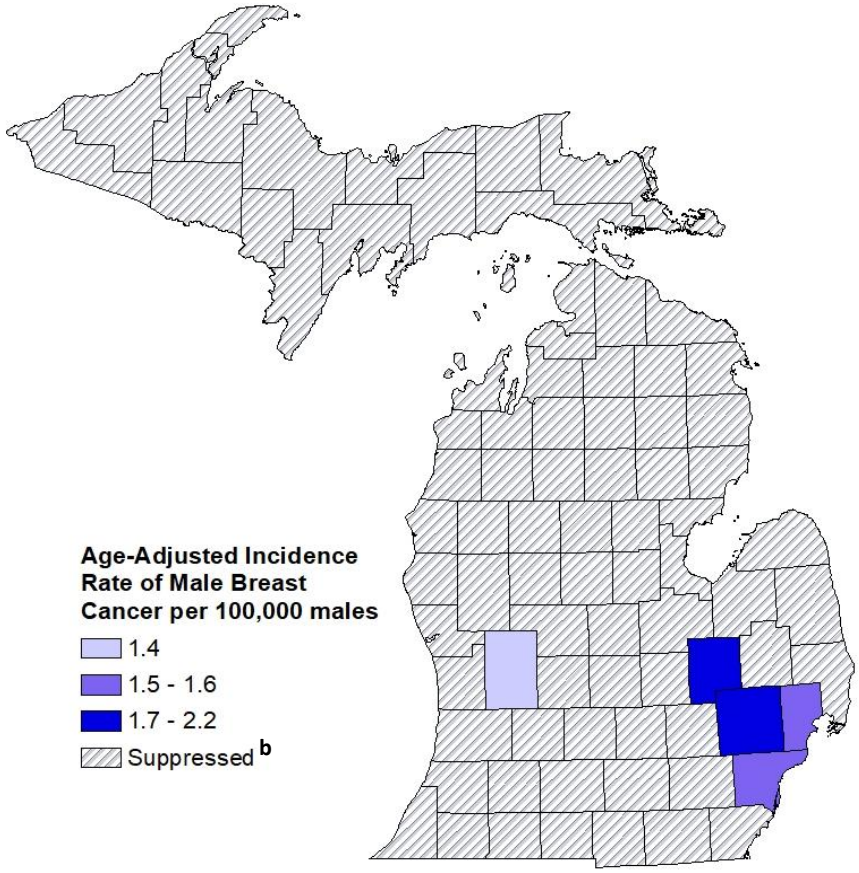


Data Source: MDHHS MCSP, 2013-2017

[b] Numbers are suppressed for incidence rates for counties with age-adjusted numerators less than 20. [c] Numbers are suppressed for age-specific numerators less than six.

Male Breast Cancer Diagnosed in Michigan, 2013-2017

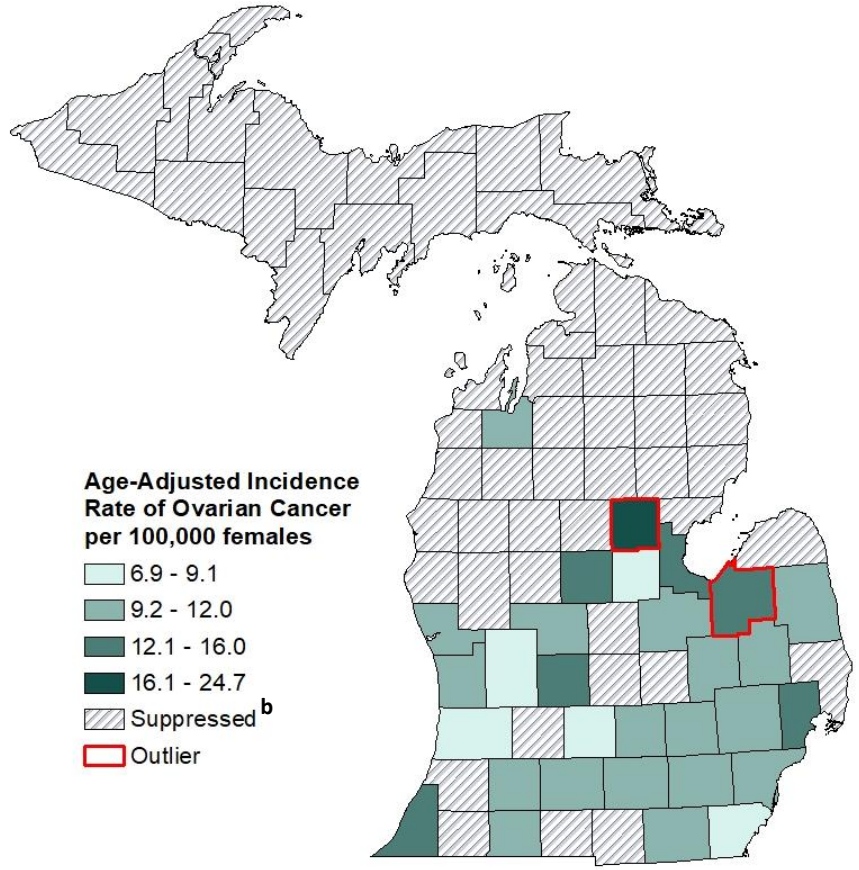
- In the general population, the risk of breast cancer among men is 1%.[5]
  - A *BRCA1* mutation increases the risk to 2-5%.[5]
  - A *BRCA2* mutation increases the risk to 5-10%.[5]
- The age-adjusted incidence for male breast cancer in Michigan during this timeframe is 1.4 per 100,000 males.
- There were no counties in Michigan that were considered outliers for male breast cancer.
- Among patients in the BRCA & HCN databases from 2013 to 2017, 0.6% of males were diagnosed with breast cancer.



Data Source: MDHHS MCSP, 2013-2017

Ovarian Cancer Diagnosed in Michigan Women, 2013-2017

- In the general population, the risk of ovarian cancer is 0.7%.[6]
  - A *BRCA1* mutation increases the risk to 16-68%.[2]
  - A *BRCA2* mutation increases the risk to 11%-30%.[2]
  - Having Lynch syndrome increases one's risk to 4-12%.[7]
- About 18% of ovarian cancers are considered heritable.[8]
- The age-adjusted incidence for ovarian cancer in Michigan during this timeframe is 10.7 per 100,000 females.
- The counties that have incidence rates that are considered outliers are:
  - Gladwin
  - Tuscola
- Five percent of patients in the BRCA & HCN databases between 2013 and 2017 were diagnosed with ovarian cancer.

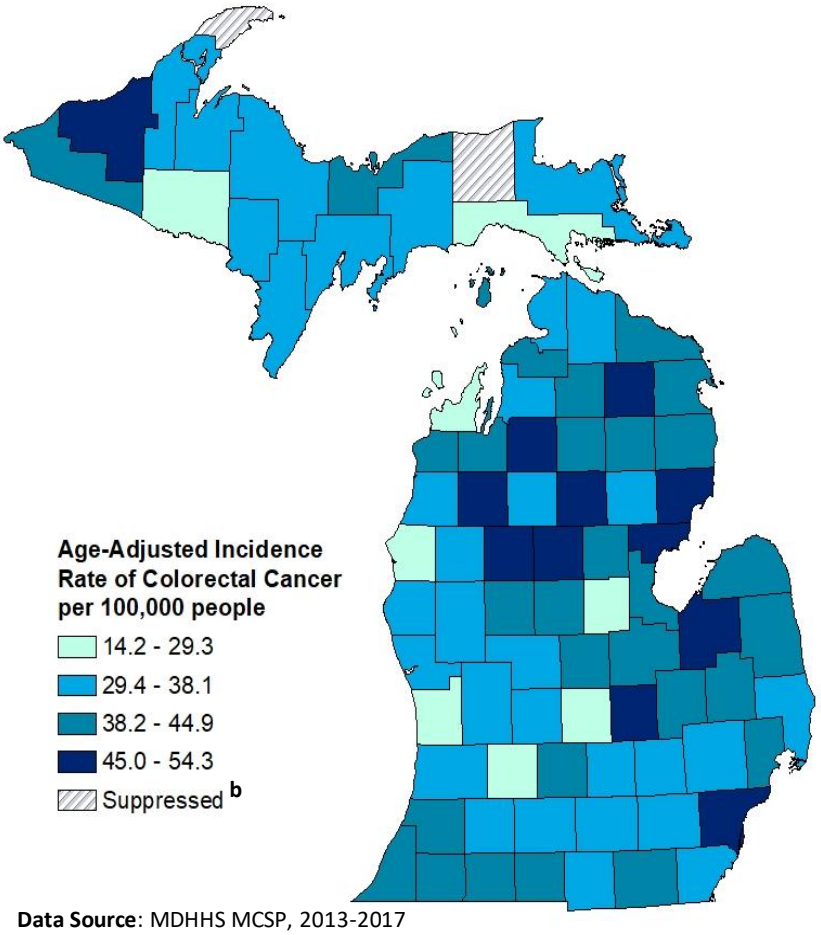


Data Source: MDHHS MCSP, 2013-2017

[b] Numbers are suppressed for incidence rates for counties with age-adjusted numerators less than 20.

Colorectal Cancer Diagnosed in Michigan, 2013-2017

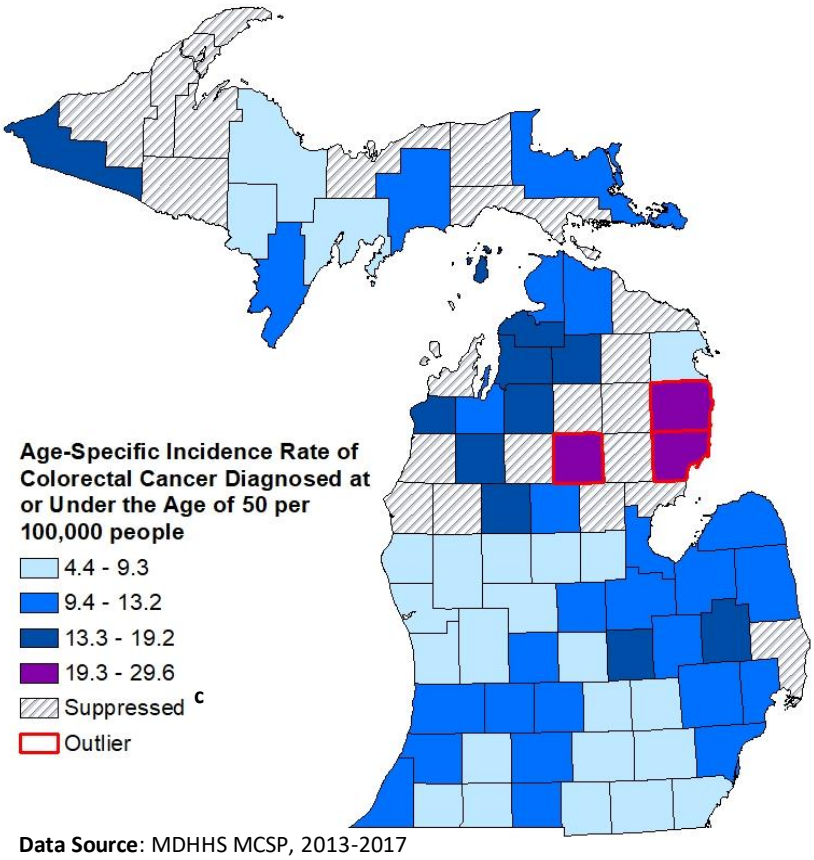
- In the general population, the risk of colorectal cancer is 4.4% for men and 4.1% for women.[11]
  - Lynch syndrome increases the risk to 52-82%.[7]
- About 5% of colorectal cancer is considered heritable.[11]
- The age-adjusted incidence for colorectal cancer in Michigan during this timeframe is 39.1 per 100,000.
- There were no counties in Michigan that had an incidence rate that was considered an outlier for colorectal cancer.
- Four percent of patients in the BRCA & HCN databases were diagnosed with colorectal cancer.



Data Source: MDHHS MCSP, 2013-2017

Young Colorectal Cancer (<50 years old) in Michigan, 2013-2017

- In 2020, it was estimated that approximately 13% of those diagnosed with colorectal cancer would be diagnosed under the age of 50.[12]
- The age-specific incidence for colorectal cancer at age 50 or younger in Michigan during this timeframe is 9.8 per 100,000.
- The counties that have incidence rates that are outliers are:
  - Iosco
  - Alcona
  - Roscommon
- Of those diagnosed with colorectal cancer from the BRCA & HCN databases, 51.6% were diagnosed before age 50.

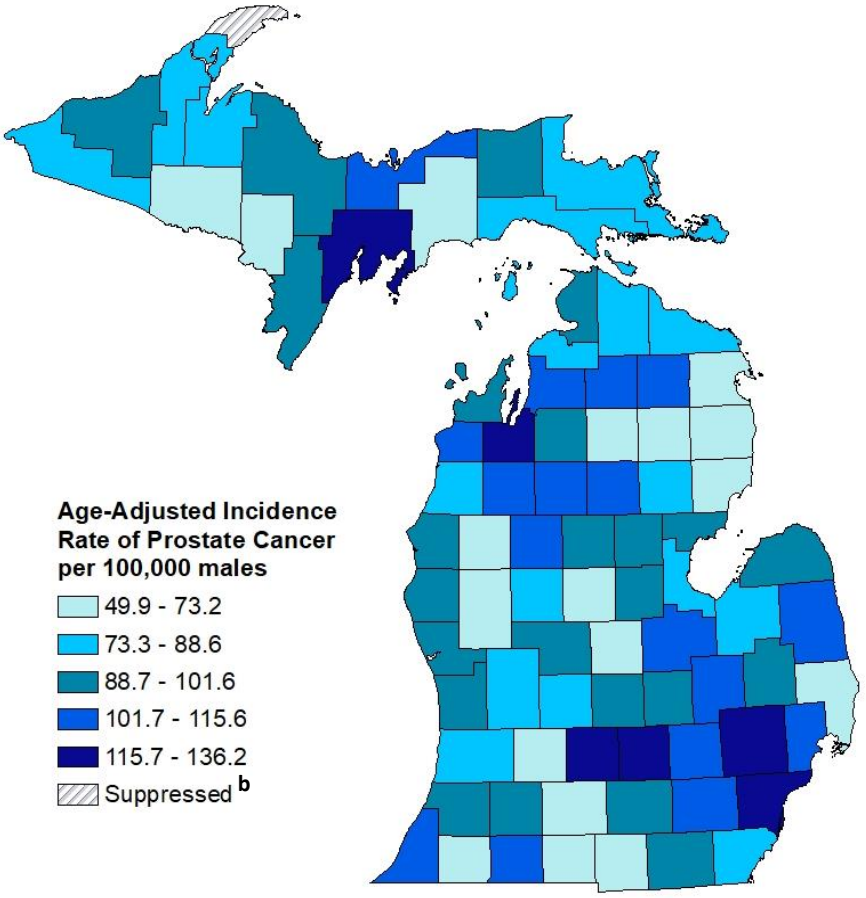


Data Source: MDHHS MCSP, 2013-2017

[b] Numbers are suppressed for incidence rates for counties with age-adjusted numerators less than 20. [c] Numbers are suppressed for age-specific numerators less than six.

Prostate Cancer Diagnosed in Michigan Men, 2013-2017

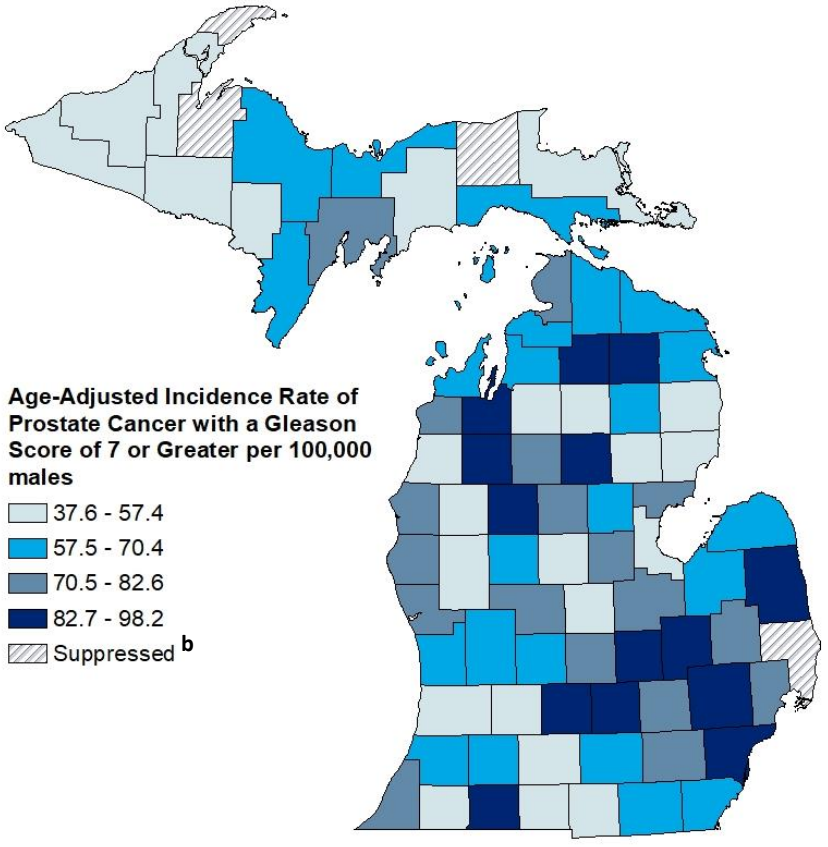
- In the general population, the risk of prostate cancer is 12.1%.[9]
  - A *BRCA1* mutation increases the risk to 20%.[4]
  - A *BRCA2* mutation increases the risk to 40%.[4]
- About 10% of prostate cancer is considered heritable.[10]
- The age-adjusted incidence for prostate cancer in Michigan during this timeframe is 105.8 per 100,000 males.
- There were no counties in Michigan that had incidence rates for prostate cancer that were considered outliers.
- One percent of patients in the BRCA & HCN databases between 2013 and 2017 were diagnosed with prostate cancer.



Data Source: MDHHS MCSP, 2013-2017

Prostate Cancer Gleason Score ≥ 7 Diagnosed in Michigan Men, 2013-2017

- Between 2013 and 2017, data from the Michigan Cancer Registry shows an estimated 58.4% of those diagnosed with prostate cancer had a Gleason Score of 7 or greater.
- Having prostate cancer with a Gleason Score of 7 or greater indicates the cancer is aggressive and may be a sign of a *BRCA1/2* mutation.[4]
- The age-adjusted incidence for prostate cancer with a Gleason Score of 7 or greater in Michigan during this timeframe is 77.3 per 100,000 males.
- There were no counties in Michigan that had incidence rates for prostate cancer with a Gleason Score ≥ 7 that were considered outliers.
- Of those in the BRCA & HCN databases diagnosed with prostate cancer, 25.3% had a Gleason Score of 7 or greater.

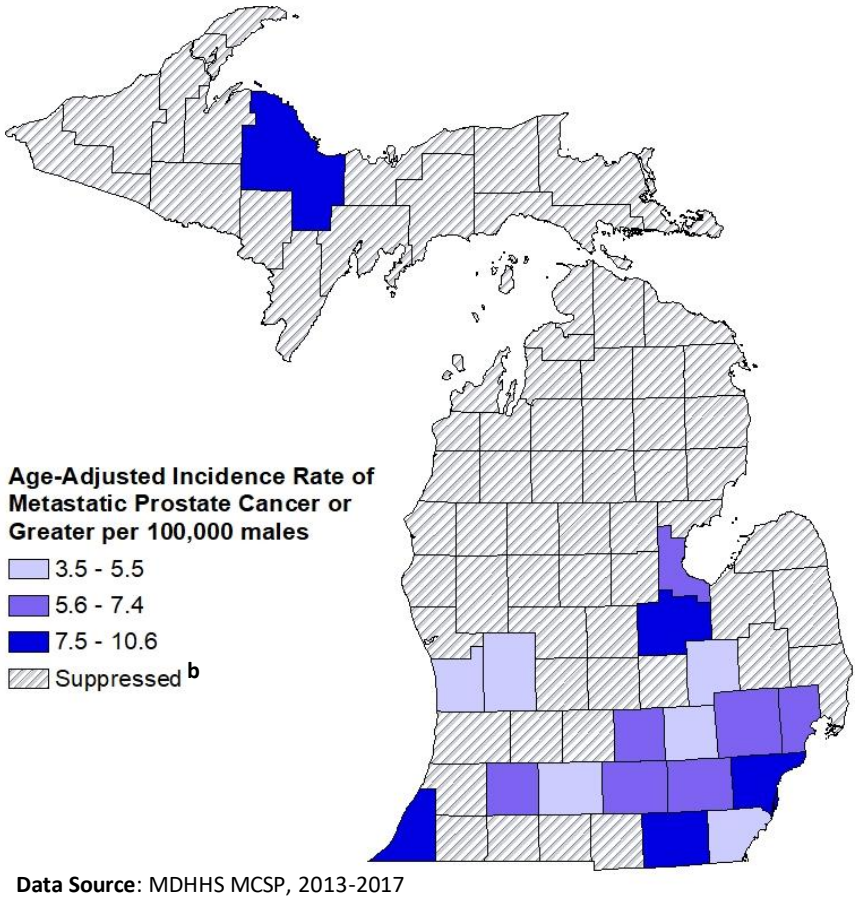


Data Source: MDHHS MCSP, 2013-2017

[b] Numbers are suppressed for incidence rates for counties with age-adjusted numerators less than 20.

Metastatic Prostate Cancer Diagnosed in Michigan Men, 2013-2017

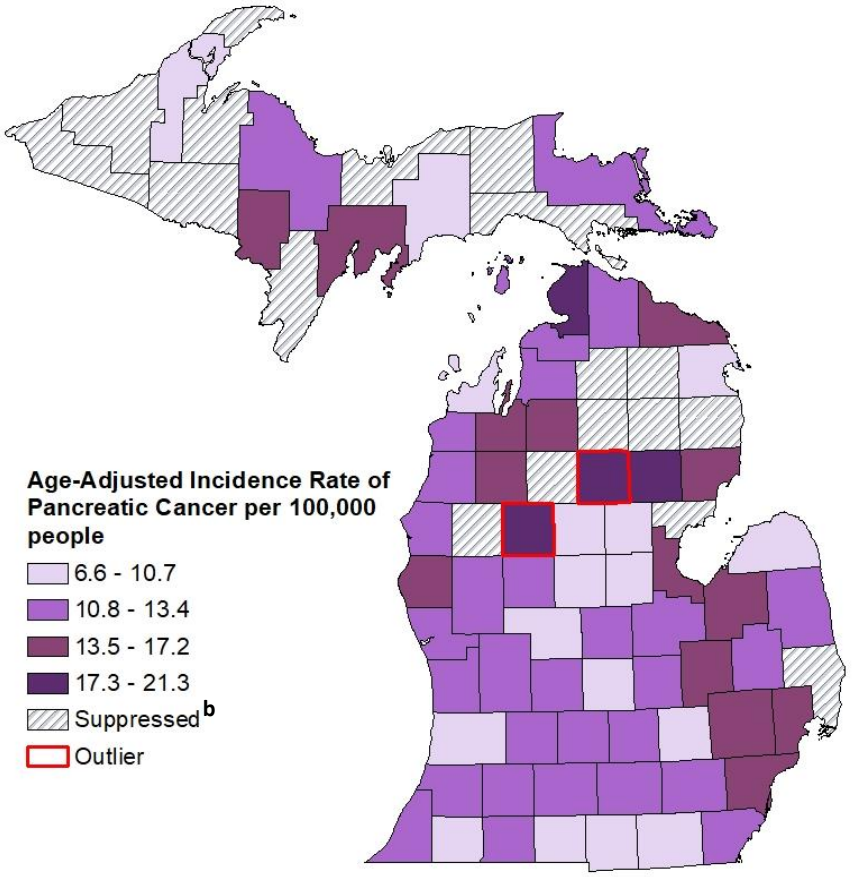
- Between 2013 and 2017, data collected by the Michigan Cancer Registry estimated that approximately 18.5% of those diagnosed with prostate cancer had metastatic prostate cancer.
- The age-adjusted incidence for metastatic prostate cancer in Michigan during this timeframe is 6.5 per 100,000 males.
- There were no counties in Michigan that had incidence rates for metastatic prostate cancer that were considered outliers.



Data Source: MDHHS MCSP, 2013-2017

Pancreatic Cancer in Michigan, 2013-2017

- In the general population, the risk of pancreatic cancer is 1.6%.[13]
  - A *BRCA1* or *BRCA2* mutation increases the risk to 2.2-5.9%.[14]
  - Having a mutation in an MMR gene increases the risk to 8.8%.[14]
- About 5-10% of pancreatic cancer is considered heritable.[14]
- The age-adjusted incidence for pancreatic cancer in Michigan during this timeframe is 13.1 per 100,000.
- The counties that had an incidence rate that was considered an outlier was:
  - Roscommon
  - Osceola
- One percent of patients in the BRCA & HCN databases were diagnosed with pancreatic cancer.

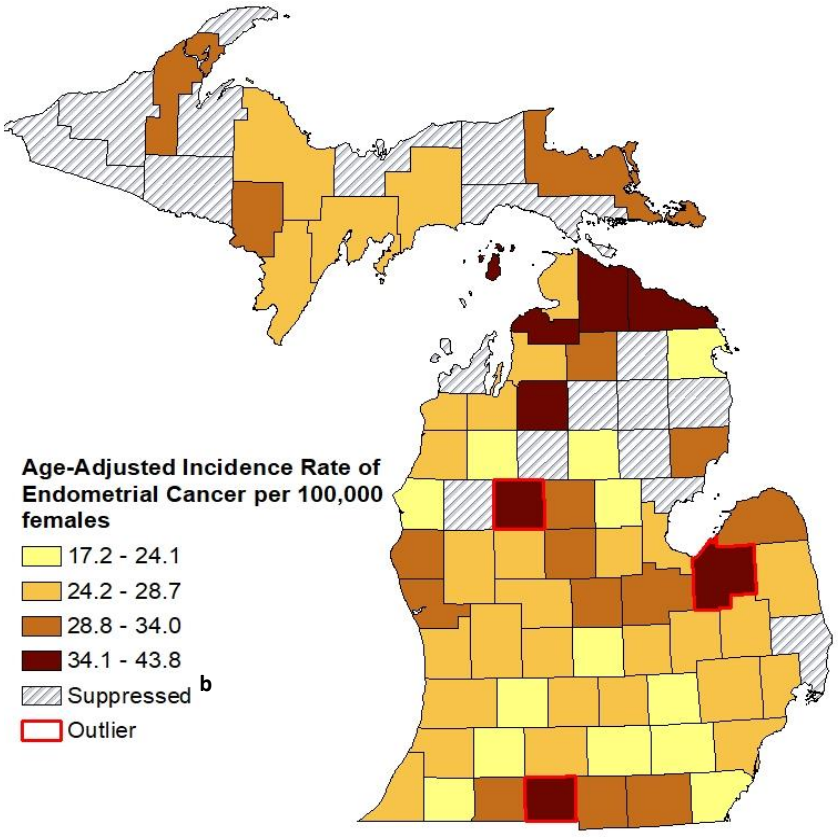


Data Source: MDHHS MCSP, 2013-2017

[b] Numbers are suppressed for incidence rates for counties with age-adjusted numerators less than 20.

Endometrial Cancer Diagnosed in Michigan Women, 2013-2017

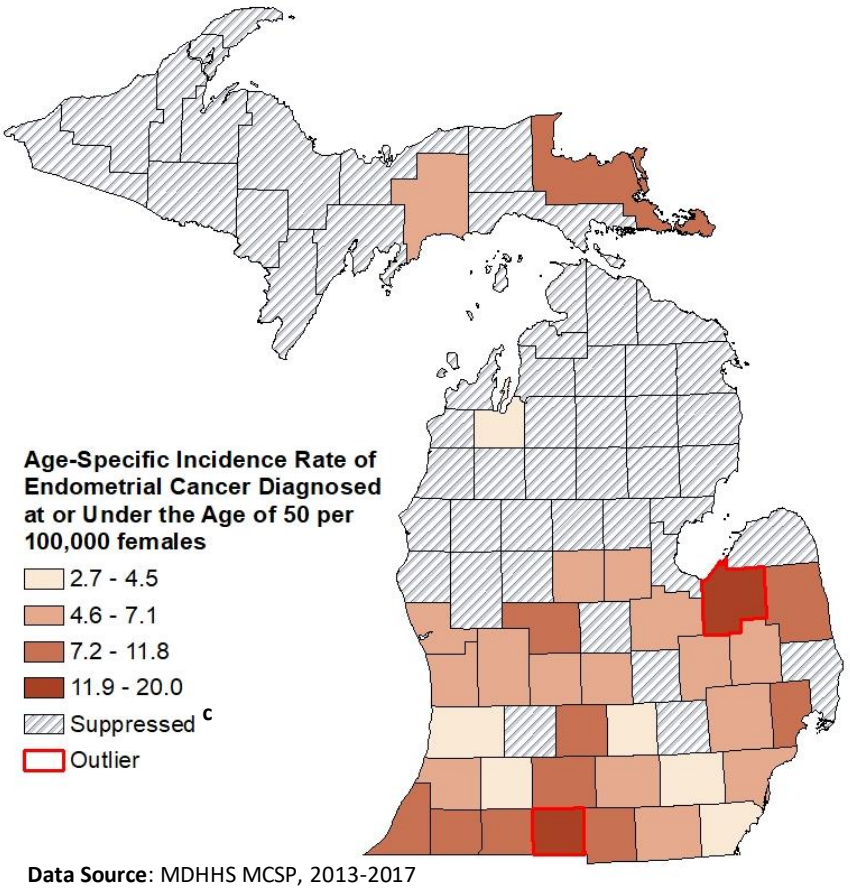
- In the general population, the risk of endometrial cancer among women is 3.1%.[15]
  - Lynch syndrome increases the risk to 25%-60%.[12]
- About 2%-12% of endometrial cancer is considered heritable.[16]
- The age-adjusted incidence for endometrial cancer in Michigan during this timeframe is 26.7 per 100,000 females.
- The counties that have incidence rates that are considered outliers are:
  - Branch
  - Osceola
  - Tuscola
- Almost 3 percent of patients in the BRCA & HCN databases were diagnosed with endometrial cancer.



Data Source: MDHHS MCSP, 2013-2017

Young Endometrial Cancer (≤50 years old) Diagnosed in Michigan Women, 2013-2017

- Approximately 11% of those who are diagnosed with endometrial cancer are diagnosed at or under the age of 50.[17]
- The age-specific incidence for endometrial cancer at age 50 or younger in Michigan during this timeframe is 5.7 per 100,000 females.
- The counties that have incidence rates that are outliers are:
  - Branch
  - Tuscola
- Of those diagnosed with endometrial cancer from the BRCA & HCN databases, 30.4% were diagnosed before the age of 50.

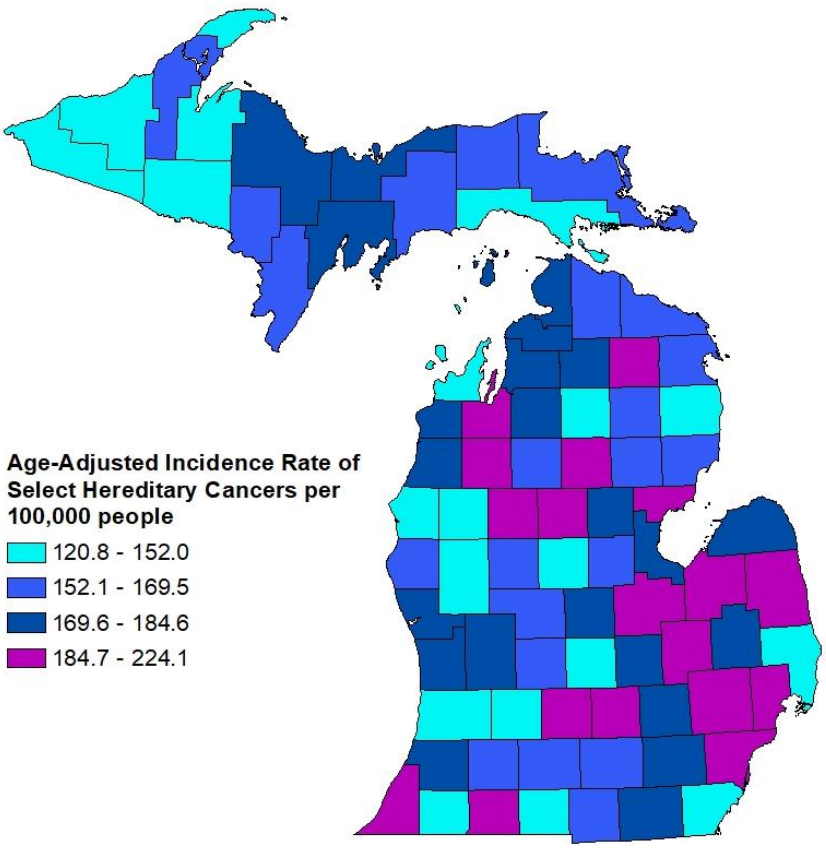


Data Source: MDHHS MCSP, 2013-2017

[b] Numbers are suppressed for incidence rates for counties with age-adjusted numerators less than 20. [c] Numbers are suppressed for age-specific numerators less than six.

Overall Incidence Rate of Selected Cancers* Combined, 2013-2017

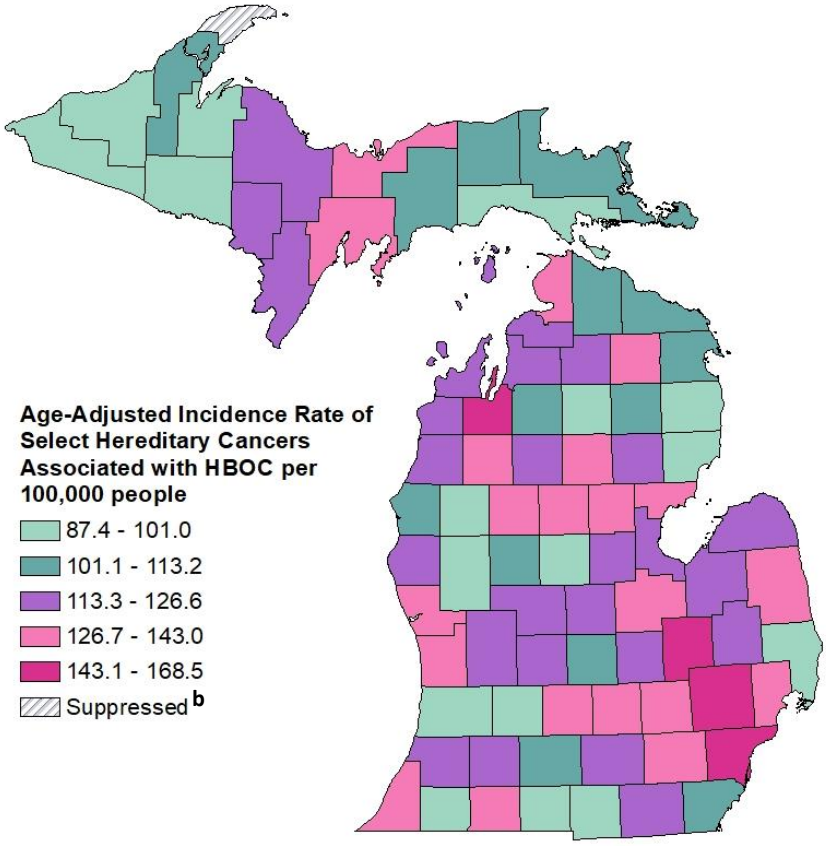
- Combined, 0.5% of the population is diagnosed with either HBOC or LS. [18-19]
- The age-adjusted incidence for select cancers often associated with HBOC and LS in Michigan is 133.2 per 100,000 people.
- There were no counties in Michigan that had incidence rates for these combined cancers that were considered outliers.
- Of those from the BRCA & HCN databases, 47.5% were diagnosed with a cancer most likely associated with HBOC.
- Of those from the BRCA & HCN databases, 9.6% were diagnosed with a cancer most likely associated with LS.



Data Source: MDHHS MCSP, 2013-2017

Incidence Rate for Select Cancers Associated with HBOC**, 2013-2017

- Less than 0.2% of the population is diagnosed with HBOC.[18]
- Other cancers associated with HBOC include prostate cancer, male breast cancer, fallopian tube cancer, pancreatic cancer, and melanoma (skin cancer).[20]
- Those from the BRCA & HCN databases, 95.1% had a genetic test looking for a genetic mutation in a gene associated with HBOC.
  - Of these who received HBOC genetic testing, 15.2% had a positive result and 10.6% had a variant of uncertain significance (VUS).



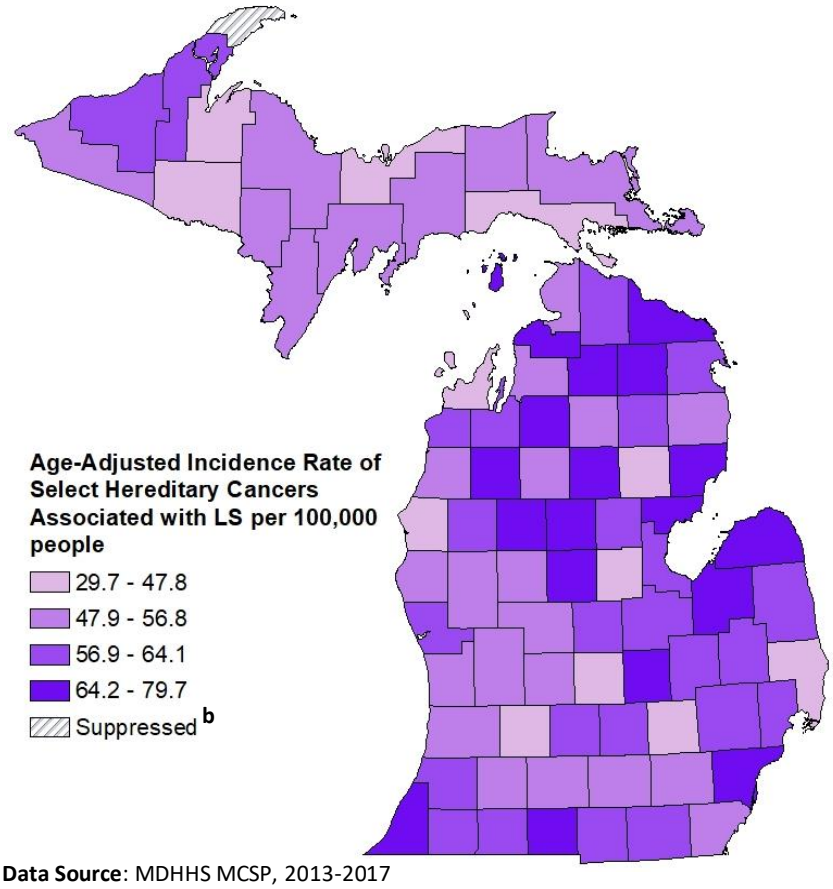
Data Source: MDHHS MCSP, 2013-2017

*Cancers of the colon, rectum, endometrium, breast, ovary, pancreas, and prostate gland.**Cancers of the breast, ovary, prostate and pancreas

[b] Numbers are suppressed for incidence rates for counties with age-adjusted numerators less than 20.

Incidence Rate for Select Cancers*** Associated with LS, 2013-2017

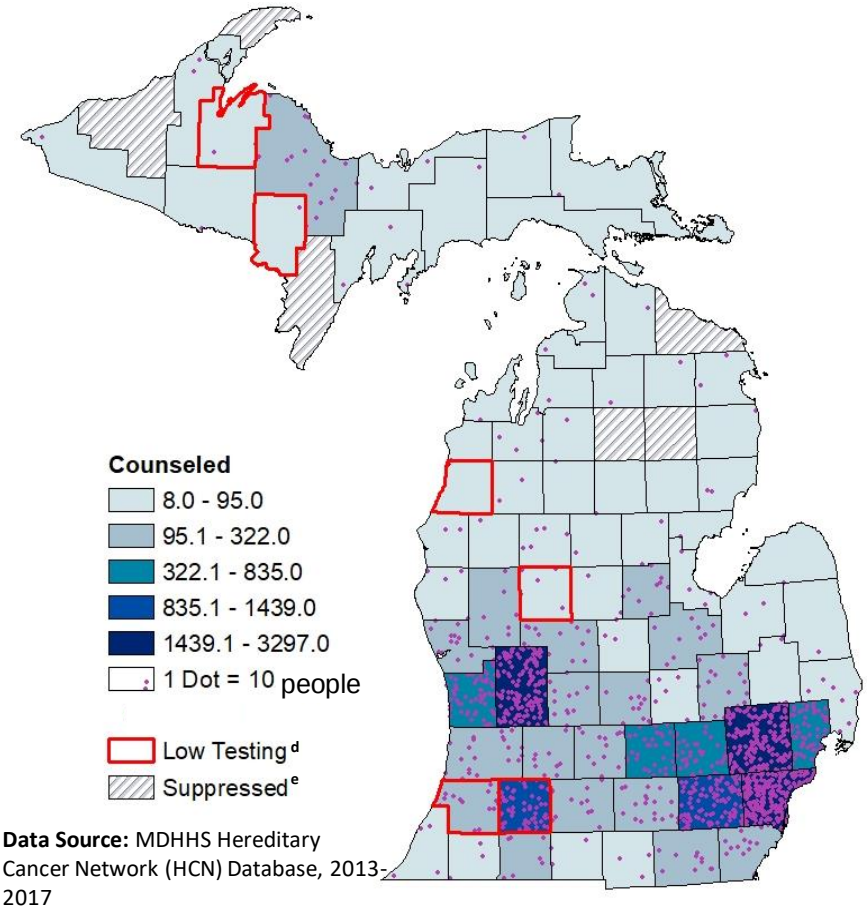
- About 0.3% of the population is diagnosed with LS.[19]
- Other types of cancers associated with LS include endometrial (uterine), stomach, breast, ovarian, small bowel (intestinal), pancreatic, prostate, urinary tract, liver, kidney, and bile duct cancers.[19]
- Of those from the BRCA & HCN databases, 53.6% had a genetic test looking for a genetic mutation in a gene associated with LS.
    - Of these who received LS genetic testing, 13.7% had a positive result and 15.1% had a VUS.



Data Source: MDHHS MCSP, 2013-2017

Genetic Counseling and Testing in Michigan from the HCN Database, 2013-2017

- Approximately 18,278 patients received genetic counseling at one of the HCN partner clinics between 2013 and 2017.
    - Of these, 12,286 (67.2%) patients received genetic testing at one of the HCN partner clinics.
- Using data collected from the HCN database, six counties in Michigan had low rates of cancer genetic testing compared to the number of those who pursued cancer genetic counseling:
    - Baraga
    - Dickinson
    - Kalamazoo
    - Manistee
    - Mecosta
    - Van Buren



Data Source: MDHHS Hereditary Cancer Network (HCN) Database, 2013-2017

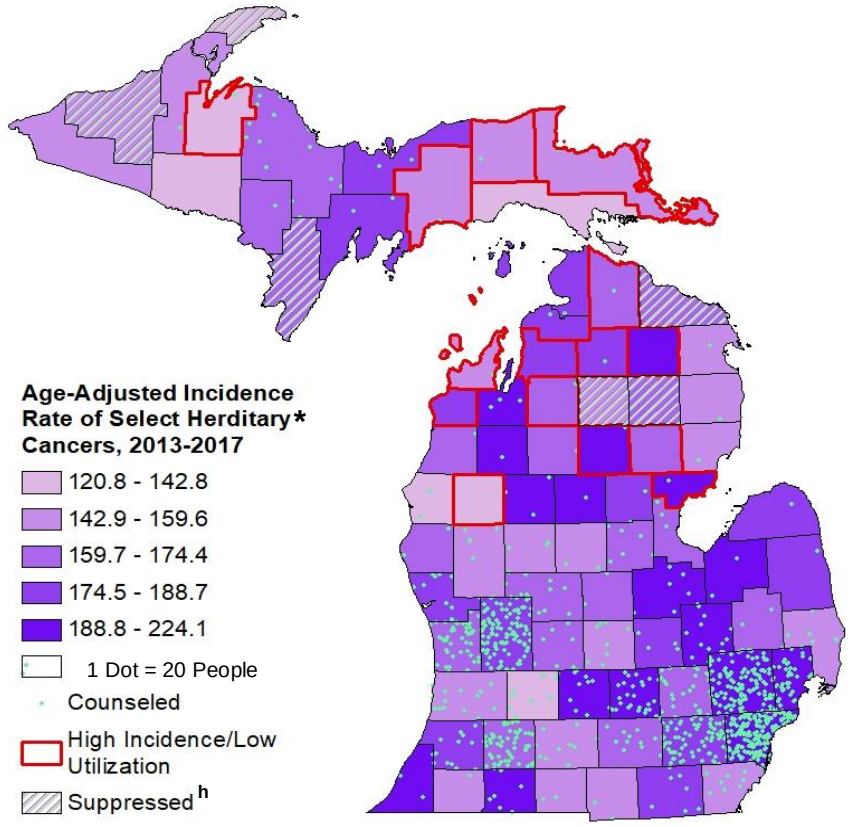
[b] Numbers are suppressed for incidence rates for counties with age-adjusted numerators less than 20. [d] Low testing is defined as having less than 59.0% of those who received cancer genetic counseling then go on to pursue cancer genetic testing. ***Cancers include endometrial, colorectal, and ovarian cancer. [e] Data are suppressed if count is less than 6.

Genetic Counseling from the Hereditary Cancer Network Database, 2013-2017

- From the HCN database, residents from counties in Northern Michigan and the Upper Peninsula appear to have the lowest utilization of cancer genetic counseling services:

- Seventeen counties have a high need for genetic counseling,[f] but have few residents utilizing genetic counseling services,[g] as reported by clinics in the HCN database.

  - Baraga
  - Schoolcraft
  - Luce
  - Chippewa
  - Cheboygan
  - Antrim
  - Montmorency
  - Leelanau
  - Benzie
  - Kalkaska
  - Ostego
  - Roscommon
  - Ogemaw
  - Arenac
  - Lake



Data Sources: MDHHS MCSP, 2013-2017
MDHHS Hereditary Cancer Network (HCN) Database, 2013-2017

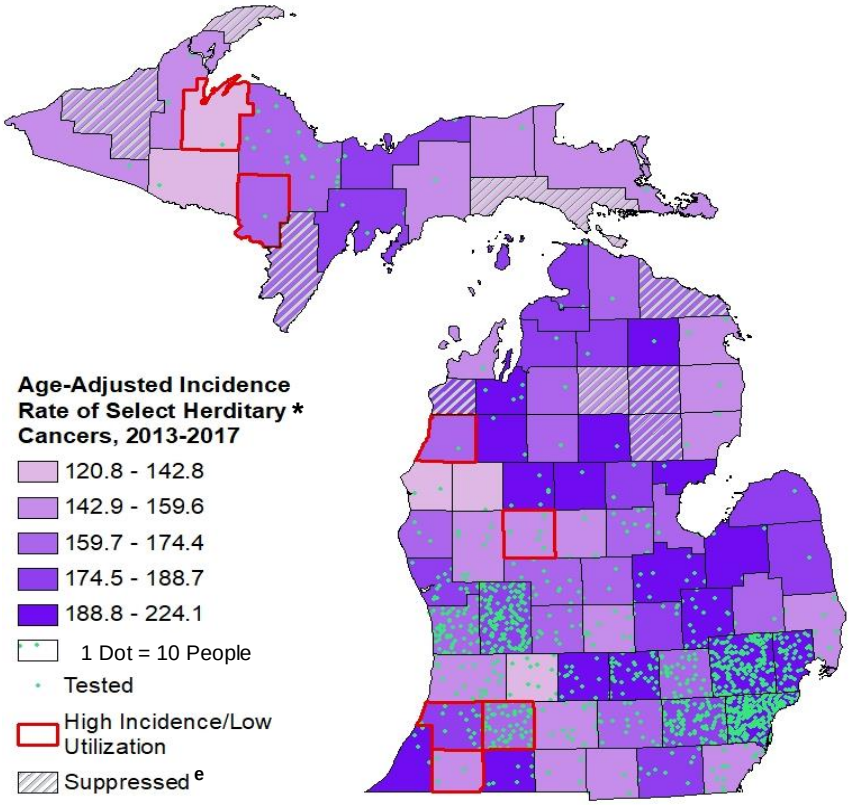
[f] High need for genetic counseling is defined as having an incidence rate greater than 136.2 per 100,000 people. [g] Low utilization is defined as less than 16 people per county receiving genetic counseling services. * Select invasive hereditary cancers are cancers of the colon, rectum, endometrium, breast, ovary, pancreas, and prostate gland. [h] Genetic counseling numbers are suppressed if less than 6.

Genetic Testing from the Hereditary Cancer Network Database, 2013-2017

- From the HCN database, residents from counties in Northwest, Southwest, and Upper Peninsula of Michigan have the lowest utilization of cancer genetic testing services:

- Seven counties have a high need for genetic testing,[i] but have few residents utilizing genetic testing services,[j] as reported by clinics in the HCN.

  - Baraga
  - Dickinson
  - Manistee
  - Mecosta
  - Kalamazoo
  - Van Buren
  - Cass



Data Sources: MDHHS MCSP, 2013-2017
MDHHS Hereditary Cancer Network (HCN) Database, 2013-2017

[i] High need for genetic counseling is defined as having an incidence rate greater than 136.2 per 100,000 people. [j] Low utilization is defined as less than 60% of people per county receiving genetic testing services. * Select invasive hereditary cancers are cancers of the colon, rectum, endometrium, breast, ovary, pancreas, and prostate gland. [e] Genetic counseling numbers are suppressed if less than 6.

Summary

By analyzing the geographic distribution of specific cancers and genetic counseling, areas that need to be targeted for future interventions can be identified. Grand Traverse County has the overall highest need for genetic counseling based on the high incidence of cases most likely to have an underlying genetic predisposition resulting from HBOC or LS. Seventeen counties that have an overall high burden for possible hereditary cancer but are in the bottom quarter for residents seeking genetic counseling services. An additional seven counties are at the bottom quarter for residents pursuing genetic testing. Possible barriers for patients to receive genetic counseling and testing may include health insurance and transportation, so it is recommended that future programs focus on these areas to increase genetic services utilization. This analysis does have limitations. Genetic counseling by someone who is not board certified, or by a clinic not part of the HCN, or by a home genetic test are not included, and therefore the results may not be generalizable to all genetic counseling performed throughout the state. This also means that the results found in this report may underrepresent the number of patients who are receiving genetic counseling and testing in Michigan.

To Find More Information

Visit **www.Michigan.gov/hereditarycancer** to learn more about hereditary cancers
Visit **www.Michigan.gov/cge** to view more data on hereditary cancers
Visit **www.Michigan.gov/MCSP** to view more information on cancer statistics

Cancer Genomics Hotline Phone #: 866 852 1247
Email: genetics@michigan.gov

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