Geographic Distribution of Select Hereditary Cancers and Cancer Genetic Services in Michigan by Race, 2014-2018

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. Among women younger than 45, breast cancer incidence is higher among Black women than white women.[1]

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. Colorectal cancer also disproportionately affects the Black community, where the rates are the highest of any racial/ethnic group in the United States. Black Americans are about 20% more likely to get colorectal cancer and about 40% more likely to die from it than most other groups.[2]

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. Studies have found that Black women are less likely to receive a physician recommendation for genetic counseling compared to white women, and this difference remained after adjusting for mutation risk.[3] 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 2014-2018. 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 2014-2018 (N=18,976; **White** = 16,168 & **Black** = 1,580).

Outliers

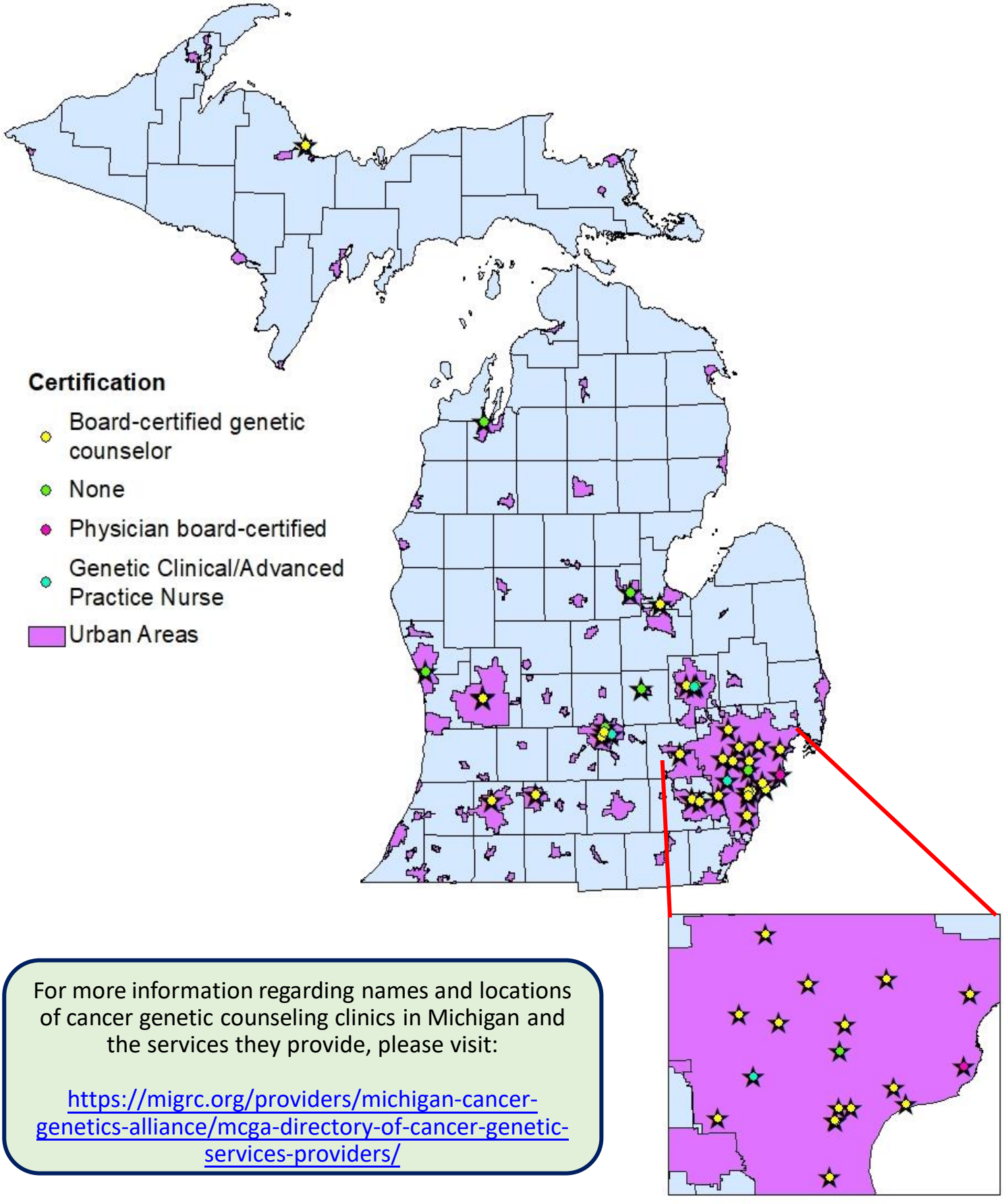
In this report, outliers refer to counties with an abnormally high incidence rate. Counties are considered outliers if the incidence rate is greater than the outlier cutoff of Q3 + (IQR*1.5), where Q3 refers to the third quartile, and IQR refers to the interquartile range (Q3-Q1). These counties are 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, 2014-2018



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, 2014-2018

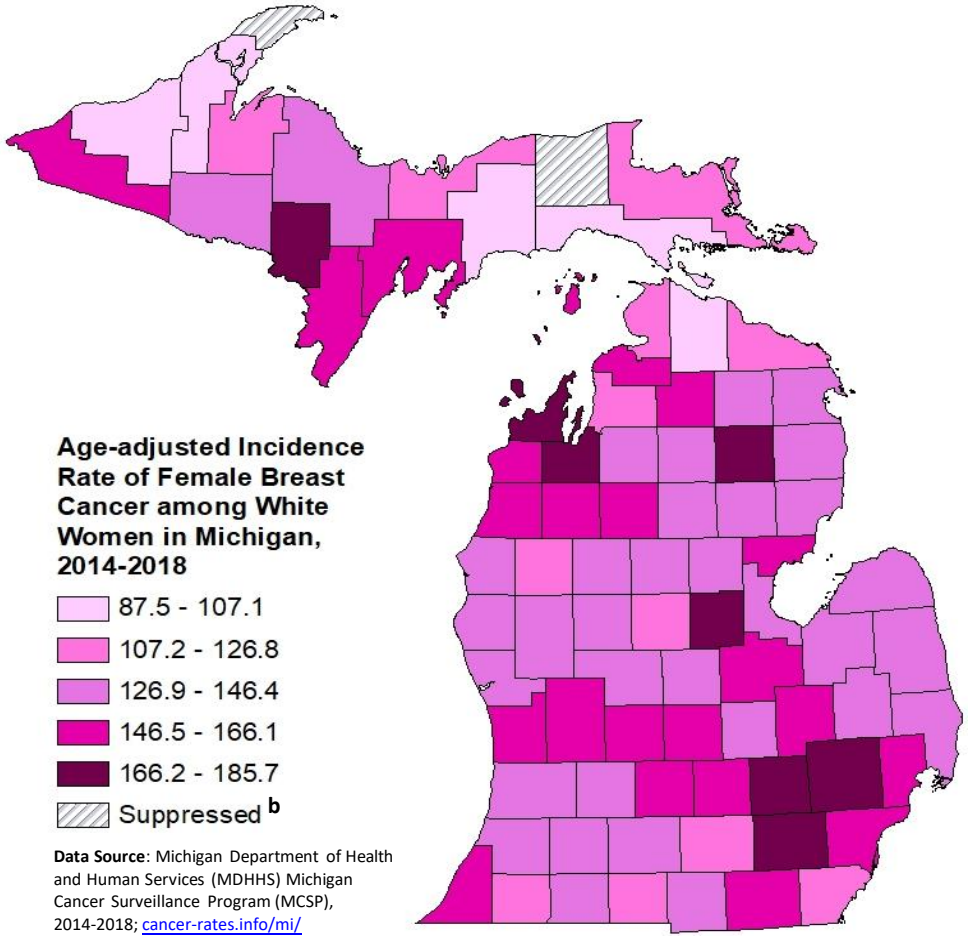
In the general population, the risk of breast cancer is 13%.[4]

A *BRCA*1 mutation increases the risk to 40%-87%.[5]

A *BRCA*2 mutation increases the risk to 27%-84%.[6]

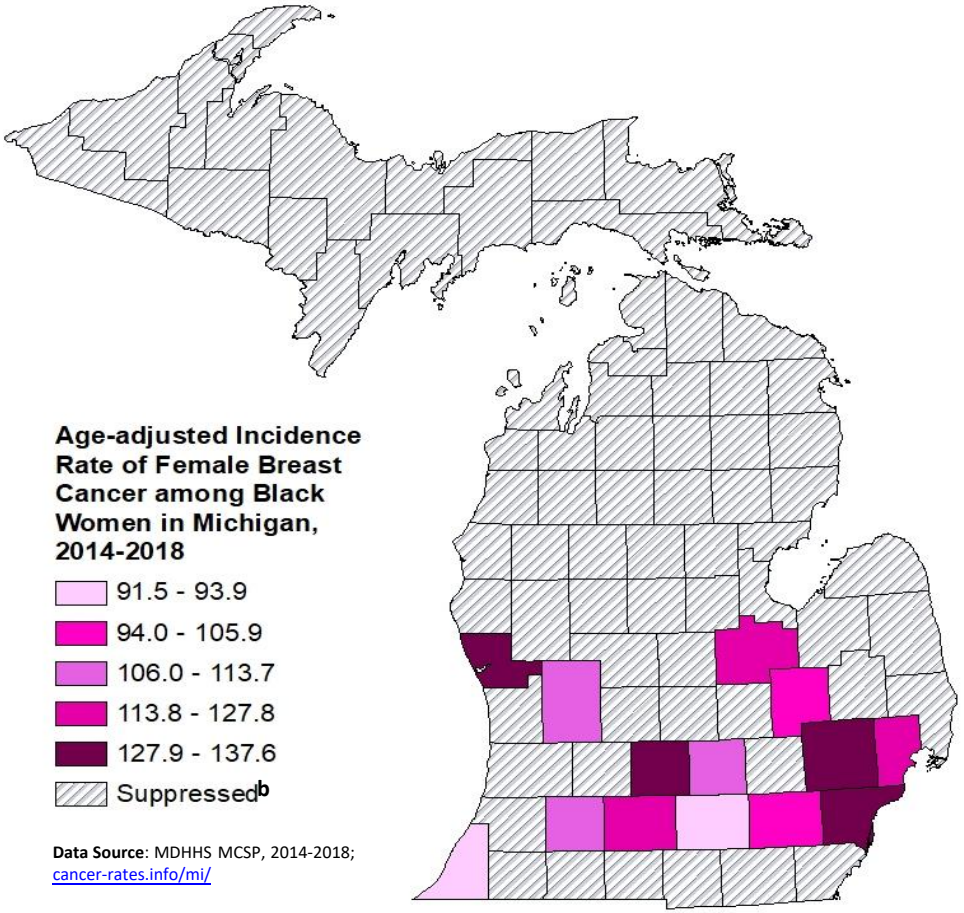
About 10% of breast cancer is considered heritable.[6]

The age-adjusted incidence for female breast cancer in Michigan is 154.5 per 100,000 females.



Data Source: Michigan Department of Health and Human Services (MDHHS) Michigan Cancer Surveillance Program (MCSP), 2014-2018; cancer-rates.info/mi/

- The age-adjusted incidence rate for female breast cancer among white women in Michigan during this timeframe is 154.3 per 100,000 females, which is higher compared to Black women.
- There were no counties in Michigan that were considered outliers for female breast cancer among white patients.
- Among patients in the BRCA & HCN databases from 2014 to 2018, 44.3% of white women were diagnosed with breast cancer.



Data Source: MDHHS MCSP, 2014-2018; cancer-rates.info/mi/

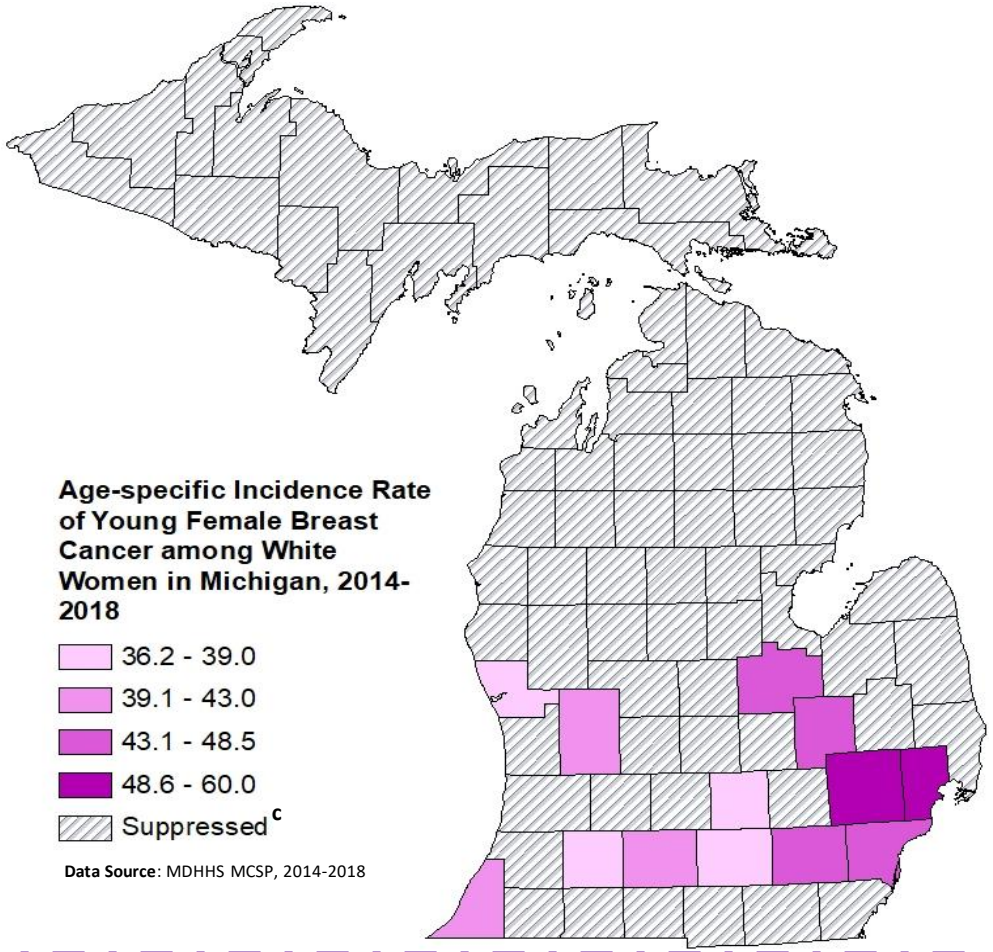
- The age-adjusted incidence rate for female breast cancer among Black women in Michigan during this timeframe is 120.2 per 100,000 females.
- There were no counties in Michigan that were considered outliers for female breast cancer among Black patients.
- Among patients in the BRCA & HCN databases from 2014 to 2018, 53.0% of Black women were diagnosed with breast cancer, which was significantly higher than breast cancer among white women.

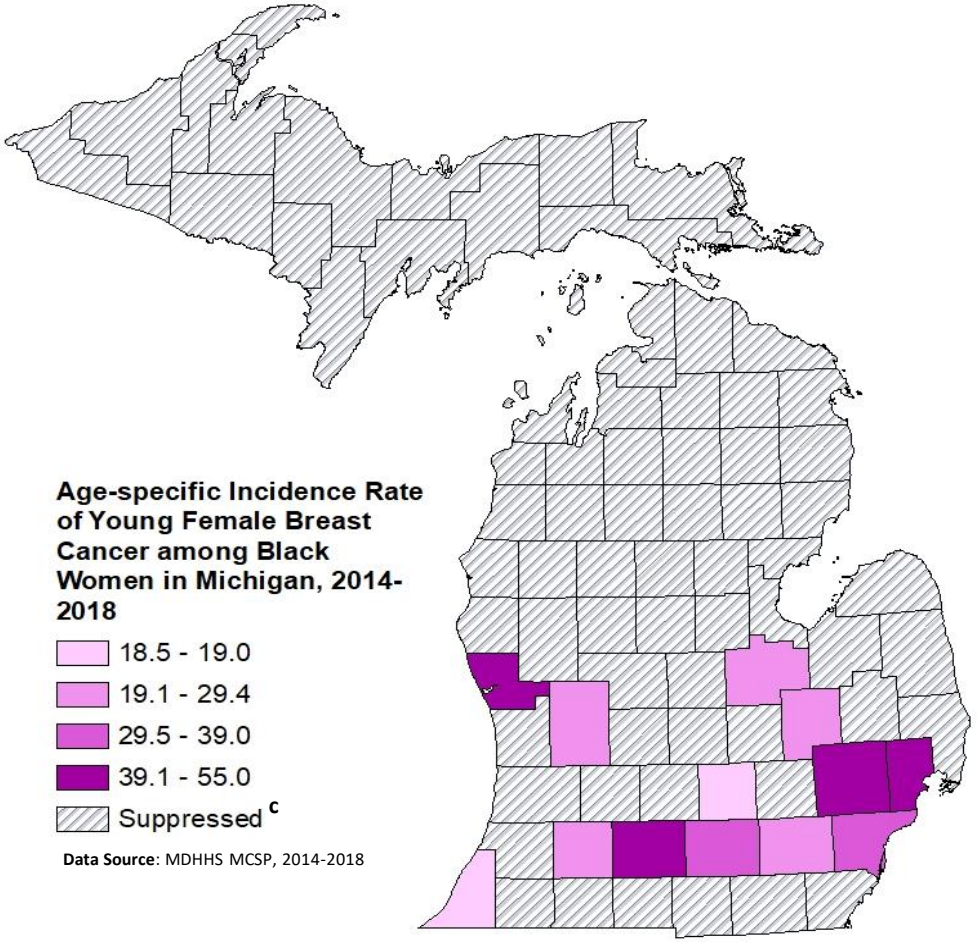
[b] Numbers are suppressed for incidence rates for counties with age-adjusted numerators less than 20.

Young Female Breast Cancer (≤50 years old) Diagnosed in Michigan, 2014-2018

Only 5% of breast cancers are diagnosed in young women, however a higher proportion of patients carry a pathogenic variant of *BRCA*1 and *BRCA*2 compared to those diagnosed at an older age.[8]

The age-adjusted incidence rate for young female breast cancer in Michigan during this timeframe is 45.6 per 100,000 females.





- The age-adjusted incidence rate for young female breast cancer among white women in Michigan during this timeframe is 47.4 per 100,000 females, which is slightly higher than the incidence rate for black women.
- There were no counties in Michigan that were considered outliers for young female breast cancer among white patients.
- Of those with breast cancer in the BRCA & HCN databases from 2014 to 2018, 32.3% of white women were diagnosed with breast cancer at age 50 or younger.

- The age-adjusted incidence rate for young female breast cancer among Black women in Michigan during this timeframe is 37.6 per 100,000 females.
- There were no counties in Michigan that were considered outliers for young female breast cancer among Black patients.
- Of those with breast cancer in the BRCA & HCN databases from 2014 to 2018, 42.4% of Black patients were diagnosed with breast cancer at age 50 or younger, which was significantly higher than breast cancer among white women.

[c] Numbers are suppressed for age-specific numerators less than six.

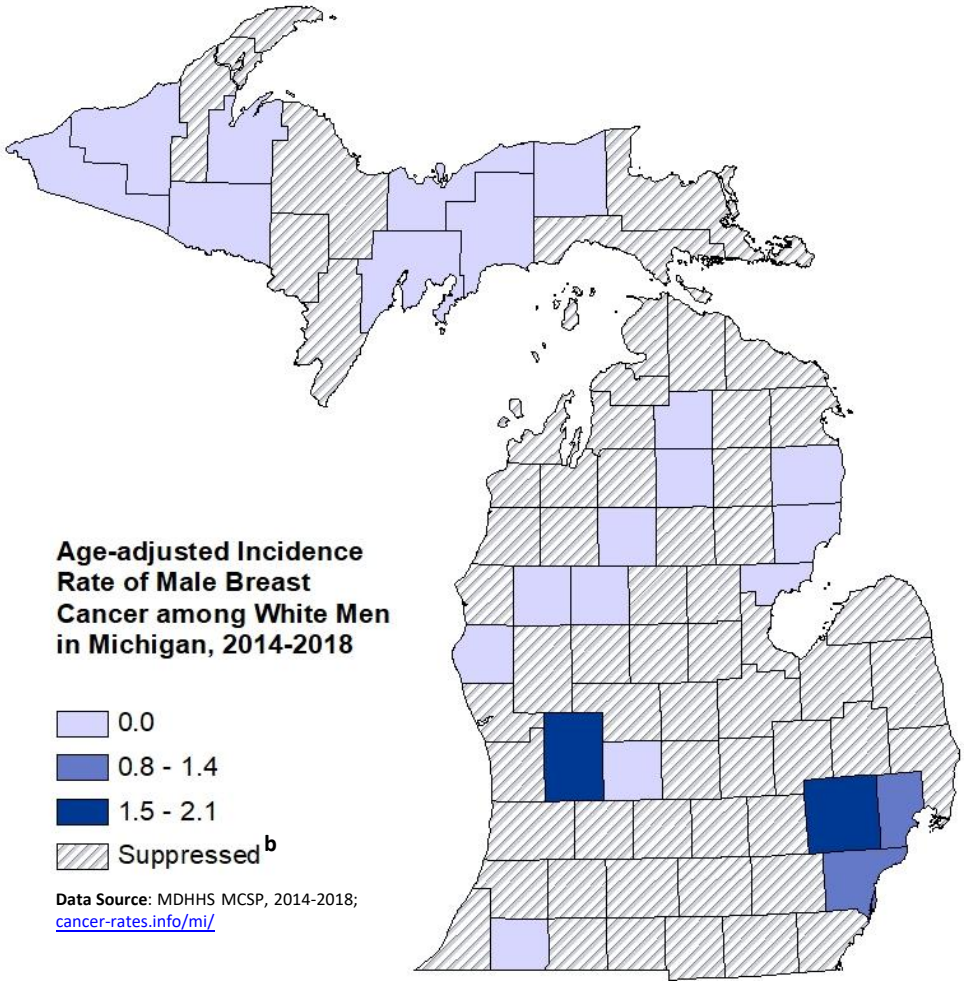
Male Breast Cancer Diagnosed in Michigan, 2014-2018

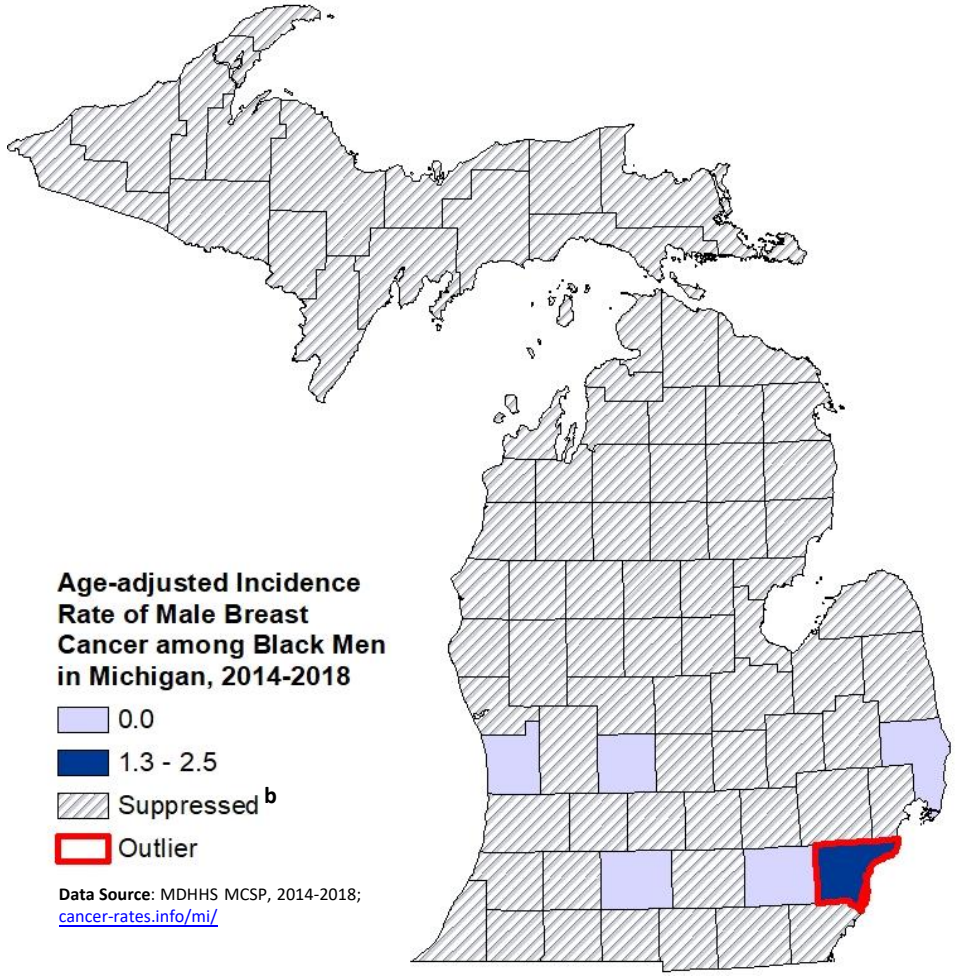
In the general population, the risk of breast cancer among men is 1%.[9]

A *BRCA*1 mutation increases the risk to 2-5%.[9]

A *BRCA*2 mutation increases the risk to 5-10%.[9]

The age-adjusted incidence rate for male breast cancer in Michigan during this timeframe is 1.6 per 100,000 males.





- The age-adjusted incidence rate for male breast cancer among white men in Michigan during this timeframe is 1.5 per 100,000 males.
- There were no counties in Michigan that were considered outliers for male breast cancer among white men.
- Among patients in the BRCA & HCN databases from 2014 to 2018, 4.2% of white males were diagnosed with breast cancer.

- The age-adjusted incidence rate for male breast cancer among Black men in Michigan during this timeframe is 2.5 per 100,000 males.
- Wayne County is the only county that is considered an outlier for male breast cancer among Black men.
- Among patients in the BRCA & HCN databases from 2014 to 2018, 6.0% of Black males were diagnosed with breast cancer.

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

Ovarian Cancer Diagnosed in Michigan Women, 2014-2018

In the general population, the risk of ovarian cancer is 0.7%.[6]

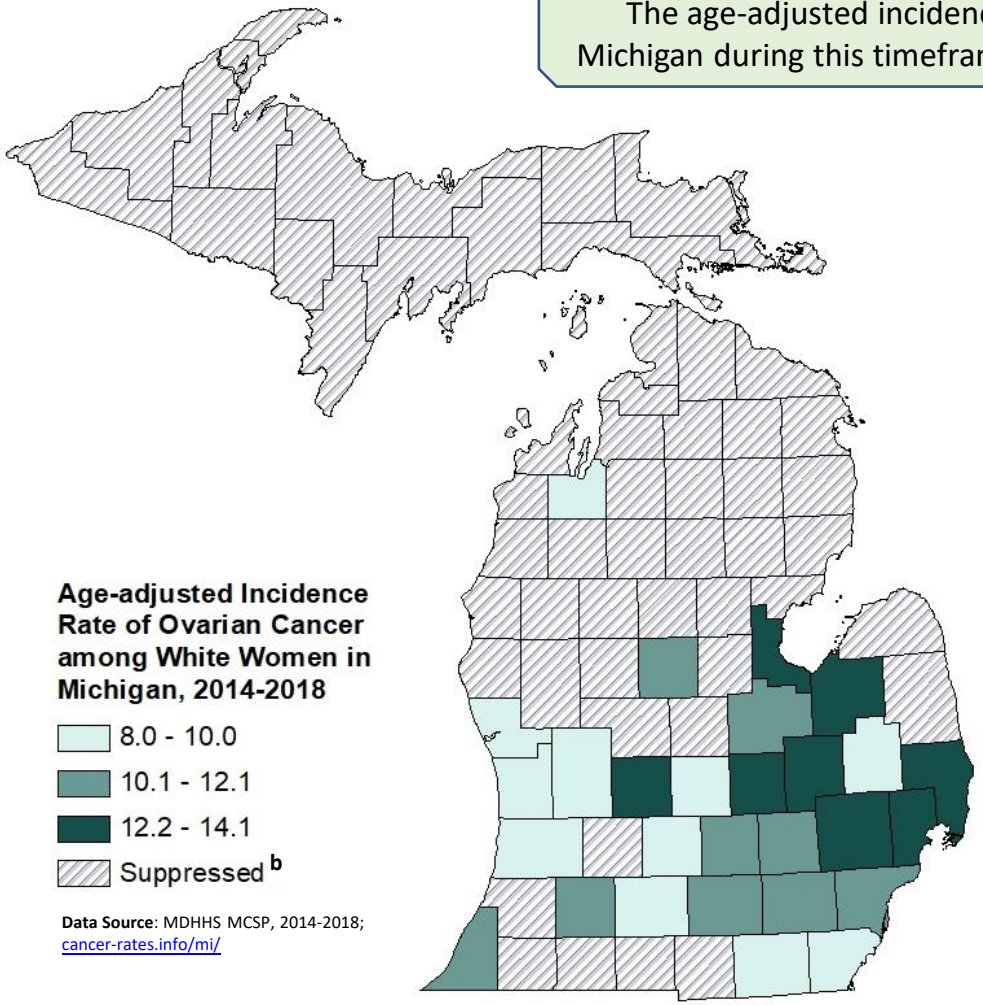
A *BRCA*1 mutation increases the risk to 16-68%.[6]

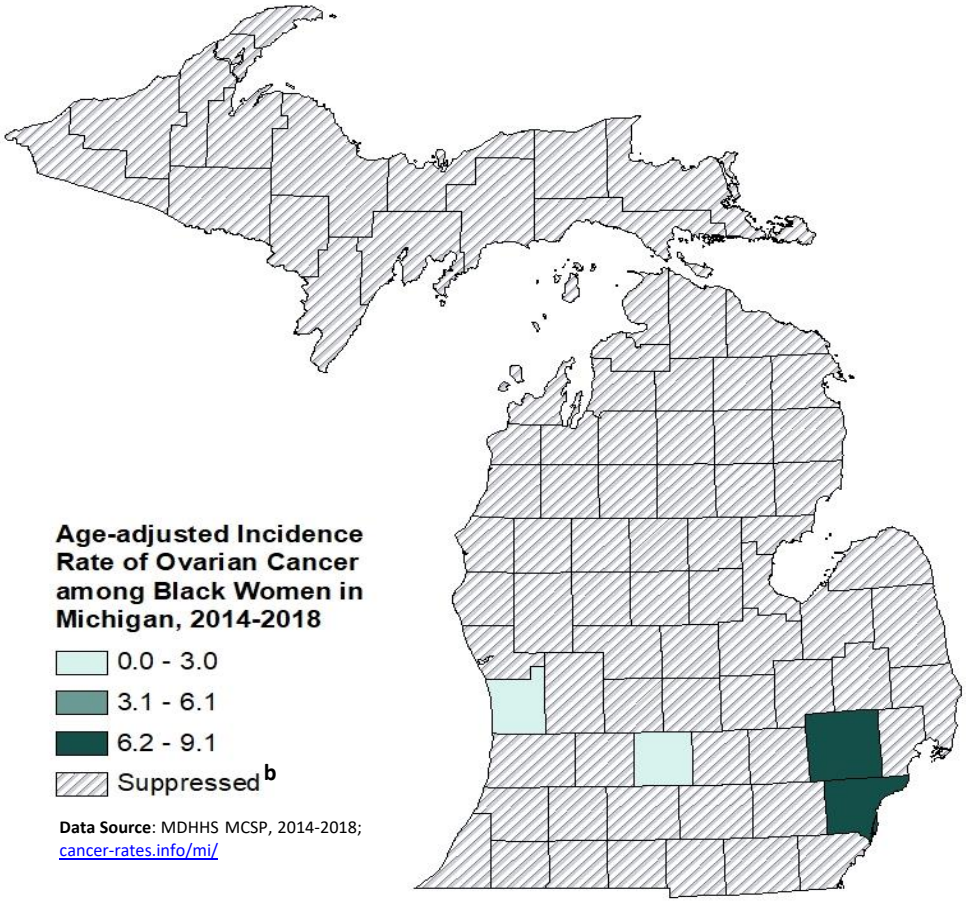
A *BRCA*2 mutation increases the risk to 11%-30%.[6]

Having Lynch syndrome increases one's risk to 4-12%.[11]

About 18% of ovarian cancers are considered heritable.[12]

The age-adjusted incidence rate for ovarian cancer in Michigan during this timeframe is 10.4 per 100,000 females.





- The age-adjusted incidence rate for ovarian cancer among white women in Michigan during this timeframe is 10.6 per 100,000 females.
- There were no counties in Michigan that were considered outliers for ovarian cancer among white patients.
- Six percent of white women in the BRCA & HCN databases between 2014 and 2018 were diagnosed with ovarian cancer, which is significantly higher than ovarian cancer among Black women.

- The age-adjusted incidence rate for ovarian cancer among Black women in Michigan during this timeframe is 8.3 per 100,000 females.
- There were no counties in Michigan that were considered outliers for ovarian cancer among white patients.
- Three percent of Black women in the BRCA & HCN databases between 2014 and 2018 were diagnosed with ovarian cancer.

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

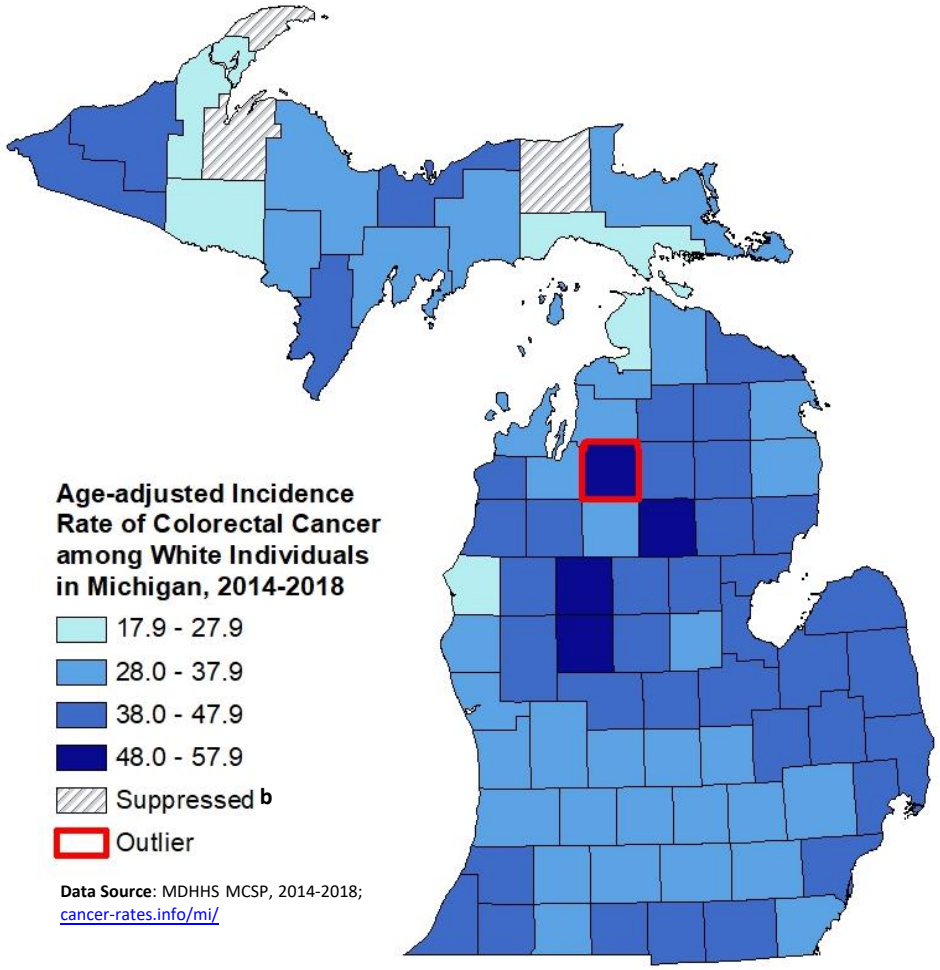
Colorectal Cancer Diagnosed in Michigan, 2014-2018

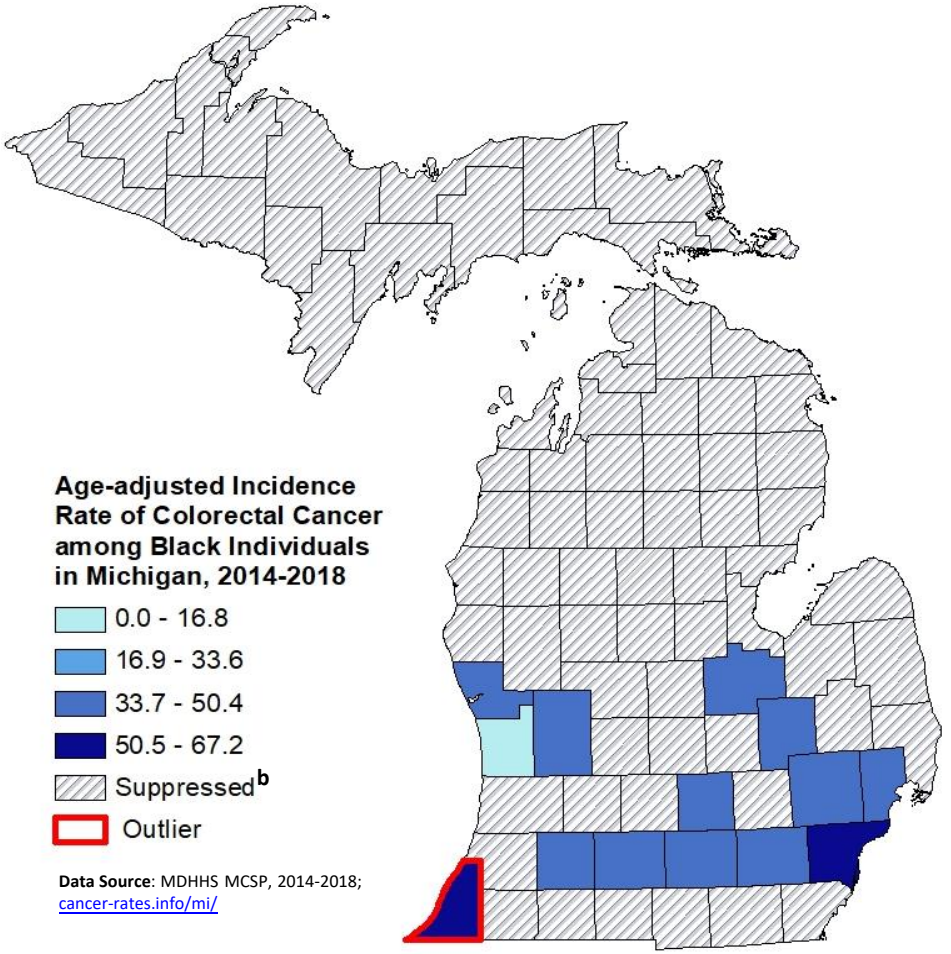
In the general population, the risk of colorectal cancer is 4.4% for men and 4.1% for women.[15]

Lynch syndrome increases the risk to 52-82%.[11]

About 5% of colorectal cancer is considered heritable.[15]

The age-adjusted incidence rate for colorectal cancer in Michigan during this timeframe is 38.6 per 100,000.





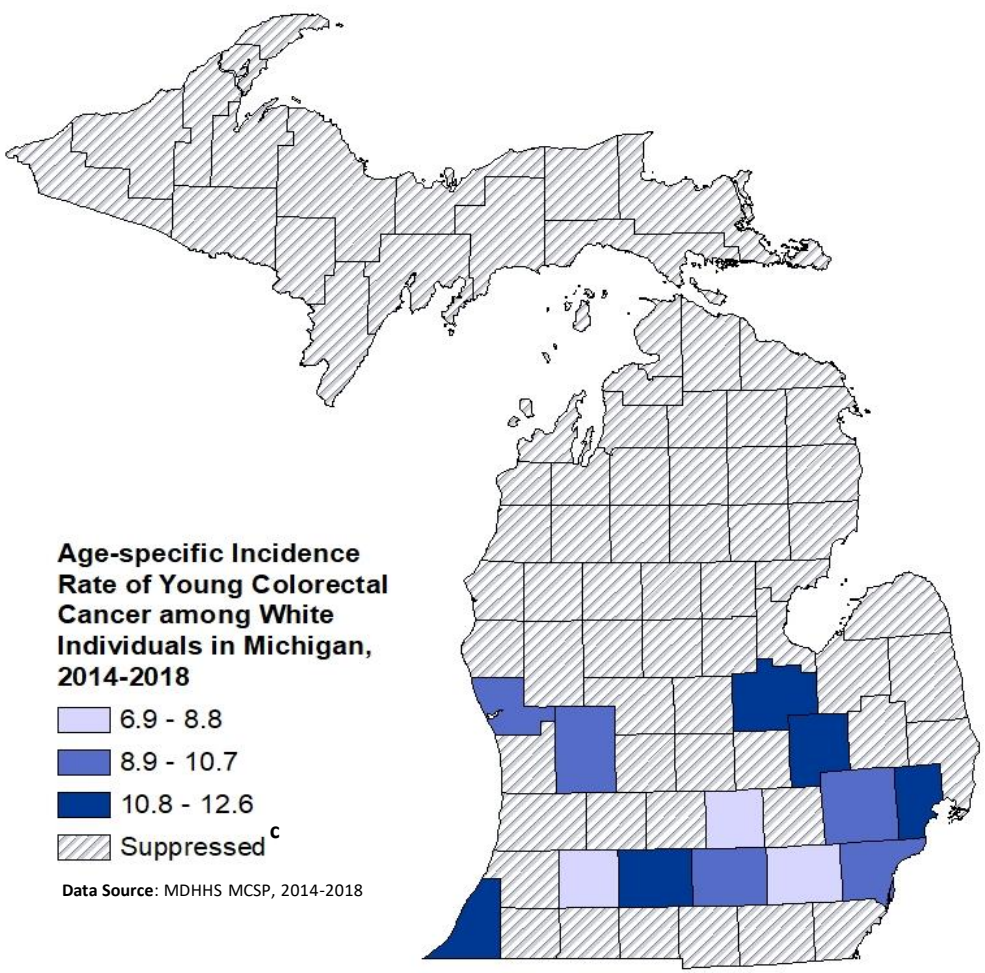
- The age-adjusted incidence rate for colorectal cancer among white men in Michigan during this timeframe is 37.4 per 100,000.
- Kalkaska was the only county that had an incidence rate that was considered an outlier for colorectal cancer among white patients.
- Five percent of white patients in the BRCA & HCN databases were diagnosed with colorectal cancer.

- The age-adjusted incidence rate for colorectal cancer among Black men in Michigan during this timeframe is 46.2 per 100,000, which is slightly higher compared to white men.
- Berrien was the only county that had an incidence rate that was considered an outlier for colorectal cancer among Black patients.
- Six percent of Black patients in the BRCA & HCN databases were diagnosed with colorectal cancer.

[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.

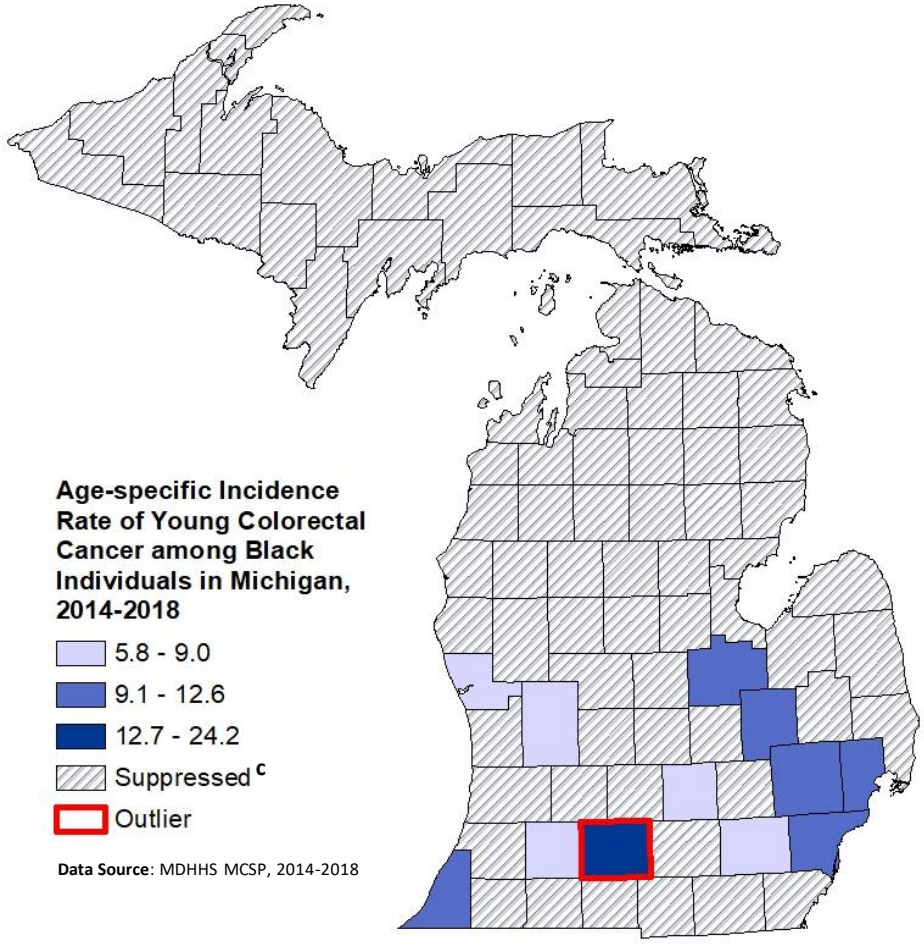
Young Colorectal Cancer (<50 years old) in Michigan, 2014-2018

In 2020, it was estimated that approximately 13% of those diagnosed with colorectal cancer would be diagnosed under the age of 50.[16]



- The age-specific incidence rate for colorectal cancer at age 50 or younger among white men in Michigan during this timeframe is 10.0 per 100,000.
- There were no counties in Michigan that were considered outliers for young colorectal cancer among white patients.
- Of those diagnosed with colorectal cancer from the BRCA & HCN databases, 51.2% of white patients diagnosed with colorectal cancer were diagnosed before age 50.

The age-specific incidence rate for colorectal cancer at age 50 or younger in Michigan during this timeframe is 10.2 per 100,000.



- The age-specific incidence rate for colorectal cancer at age 50 or younger among Black men in Michigan during this timeframe is 10.8 per 100,000.
- Calhoun is the only county in Michigan that was considered an outlier for young colorectal cancer among Black patients.
- Of those diagnosed with colorectal cancer from the BRCA & HCN databases, 54.7% of Black patients diagnosed with colorectal cancer were diagnosed before age 50.

[c] Numbers are suppressed for age-specific numerators less than six.

Prostate Cancer Diagnosed in Michigan Men, 2014-2018

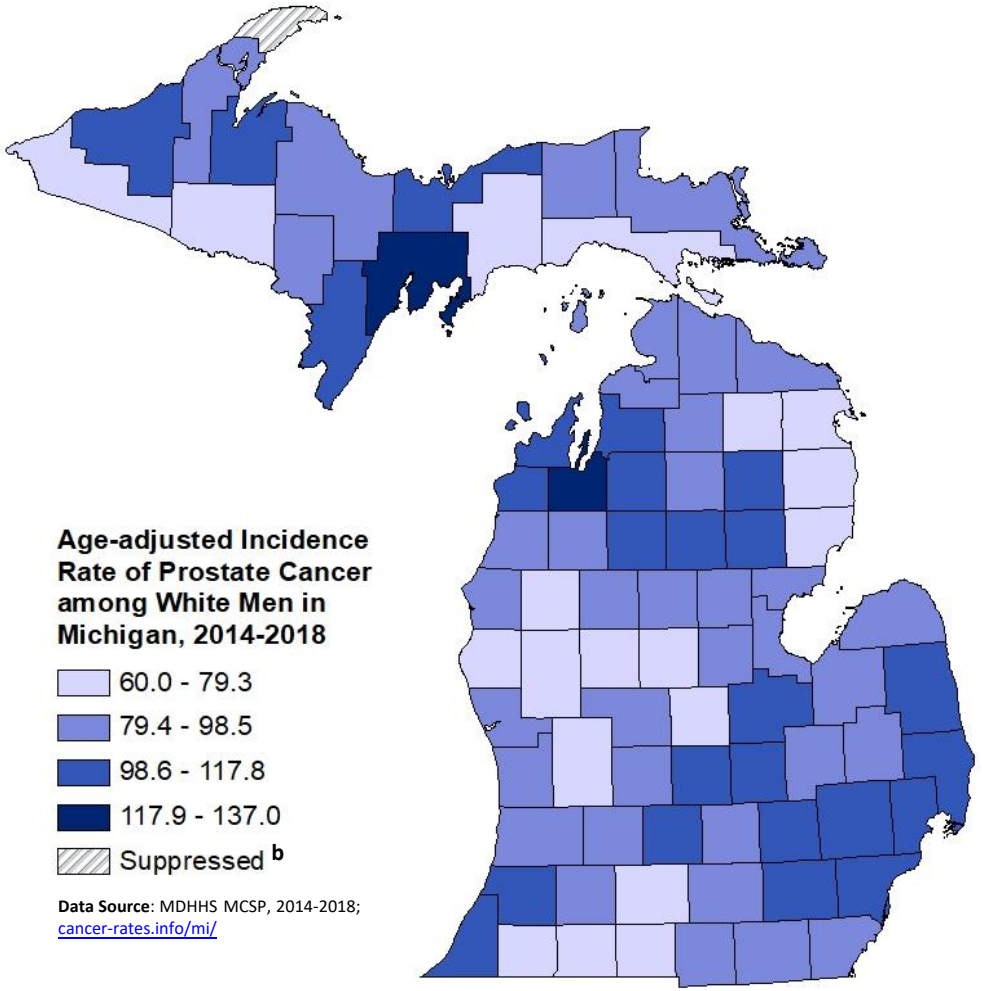
In the general population, the risk of prostate cancer is 12.1%.[13]

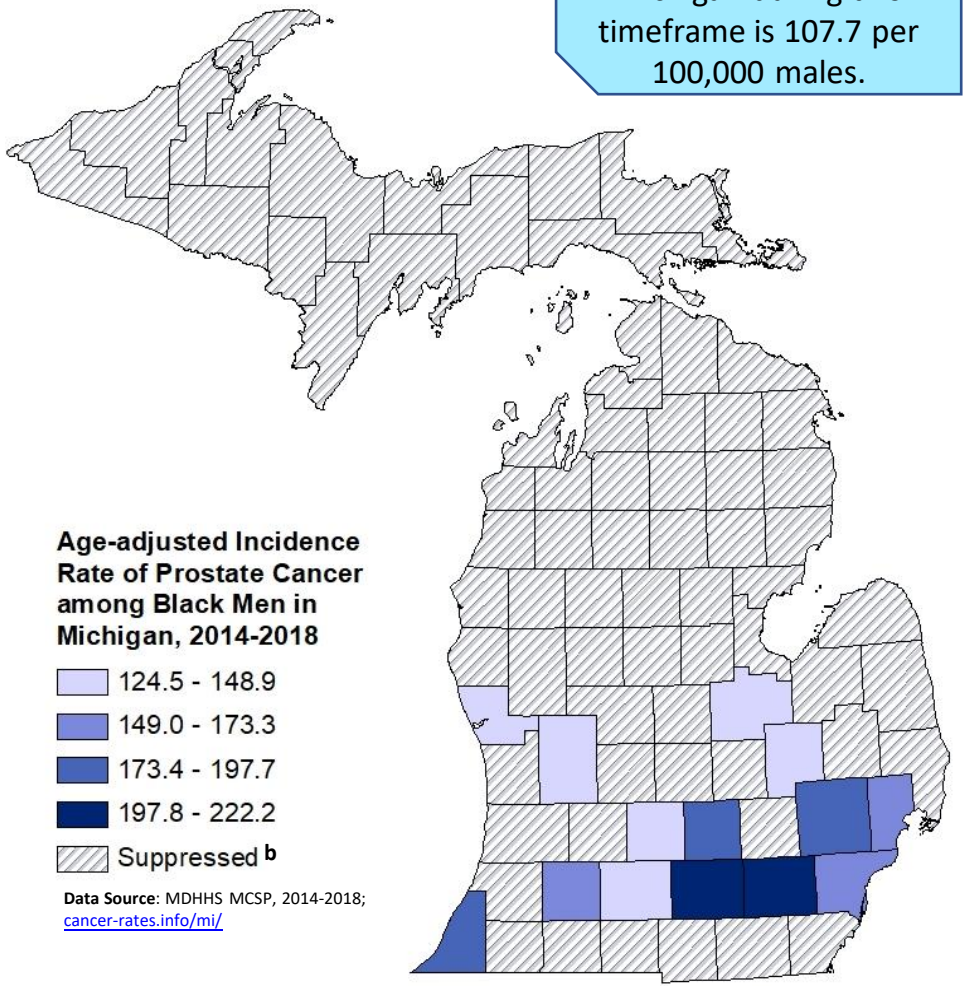
A *BRCA*1 mutation increases the risk to 20%.[8]

A *BRCA*2 mutation increases the risk to 40%.[8]

About 10% of prostate cancer is considered heritable.[14]

The age-adjusted incidence rate for prostate cancer in Michigan during this timeframe is 107.7 per 100,000 males.





- The age-adjusted incidence rate for prostate cancer among white men in Michigan during this timeframe is 97.8 per 100,000 males.
- There were no counties in Michigan that had incidence rates for prostate cancer among white men that were considered outliers.
- One and a half percent of white patients in the BRCA & HCN databases between 2014 and 2018 were diagnosed with prostate cancer.

- The age-adjusted incidence rate for prostate cancer among Black men in Michigan during this timeframe is 159.8 per 100,000 males, which is higher compared to white men.
- There were no counties in Michigan that had incidence rates for prostate cancer for Black men that were considered outliers.
- Two percent of Black patients in the BRCA & HCN databases between 2014 and 2018 were diagnosed with prostate cancer.

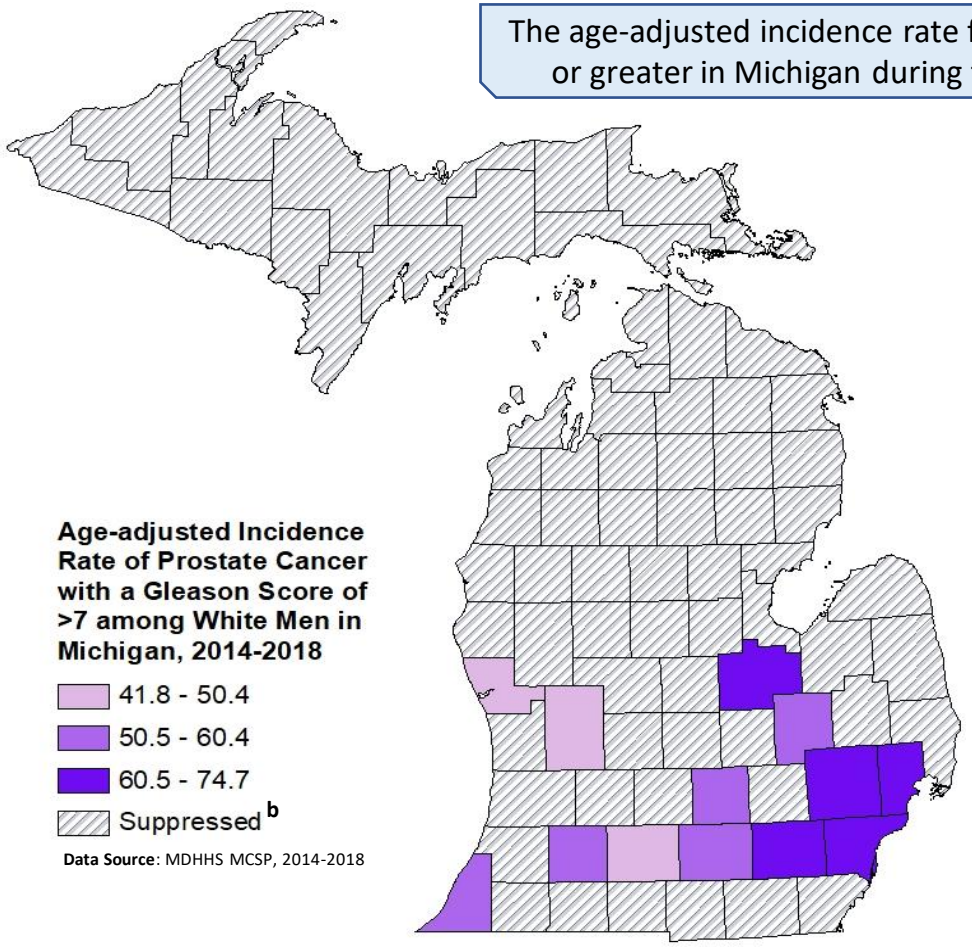
[b] Numbers are suppressed for incidence rates for counties with age-adjusted numerators less than 20.

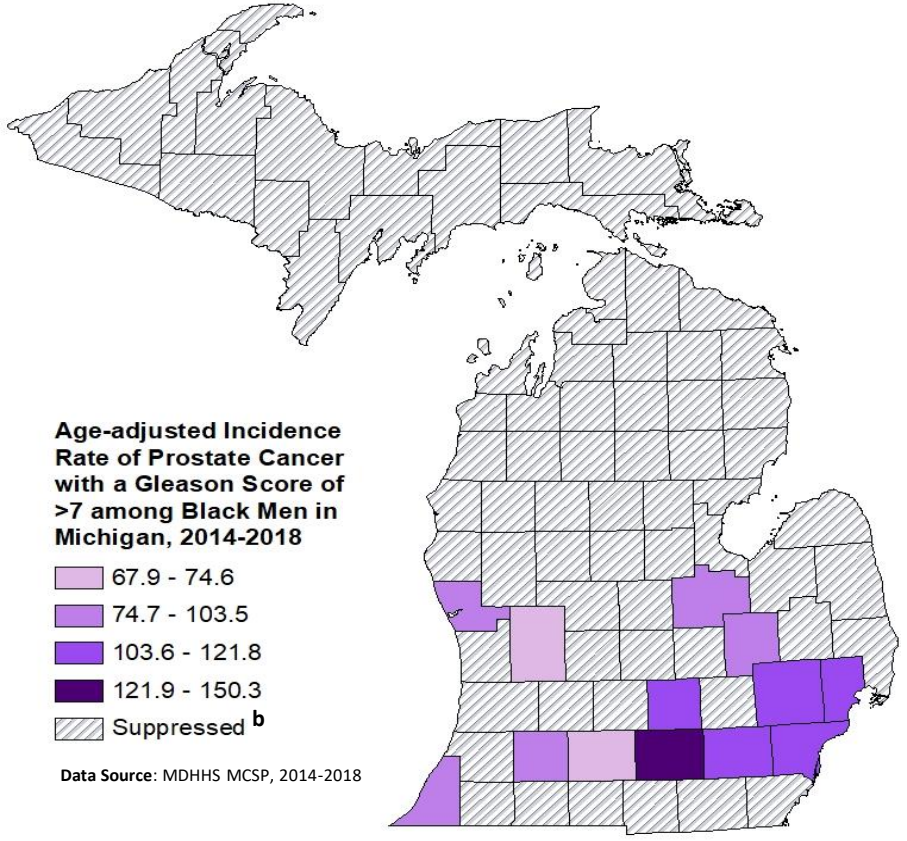
Prostate Cancer Gleason Score ≥ 7 Diagnosed in Michigan Men, 2014-2018

Between 2014 and 2018, data from the Michigan Cancer Registry shows an estimated 60.9% 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.[8]

The age-adjusted incidence rate for prostate cancer with a Gleason Score of 7 or greater in Michigan during this timeframe is 65.7 per 100,000 males.





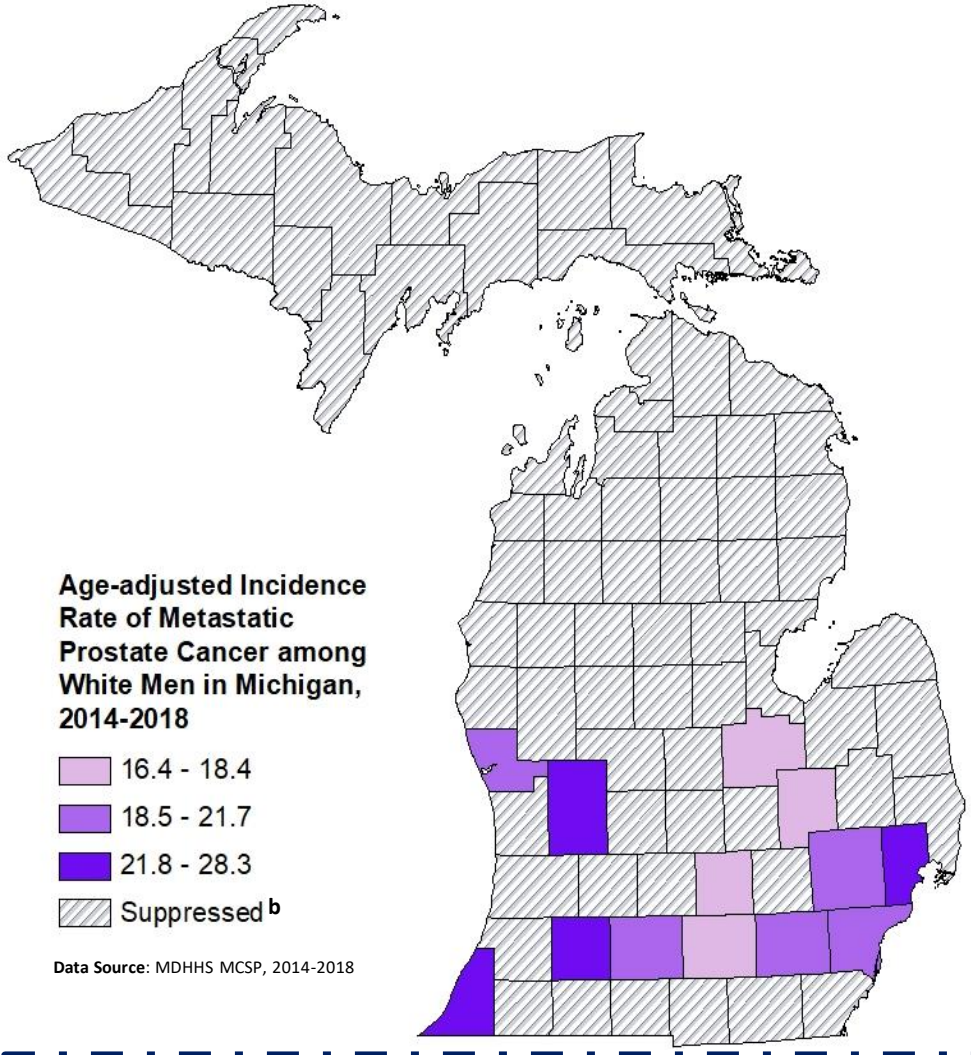
- The age-adjusted incidence rate for prostate cancer with a Gleason Score of 7 or greater among white men in Michigan during this timeframe is 60.0 per 100,000 males.
- There were no counties in Michigan that had incidence rates for prostate cancer with a Gleason Score ≥ 7 among white men that were considered outliers.
- Of the white patients in the BRCA & HCN databases diagnosed with prostate cancer, 27.0% had a Gleason Score of 7 or greater.

- The age-adjusted incidence rate for prostate cancer with a Gleason Score of 7 or greater among Black men in Michigan during this timeframe is 106.7 per 100,000 males, which is higher compared to white men.
- There were no counties in Michigan that had incidence rates for prostate cancer with a Gleason Score ≥ 7 among Black men that were considered outliers.
- Of the Black patients in the BRCA & HCN databases diagnosed with prostate cancer, 37.0% had a Gleason Score of 7 or greater.

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

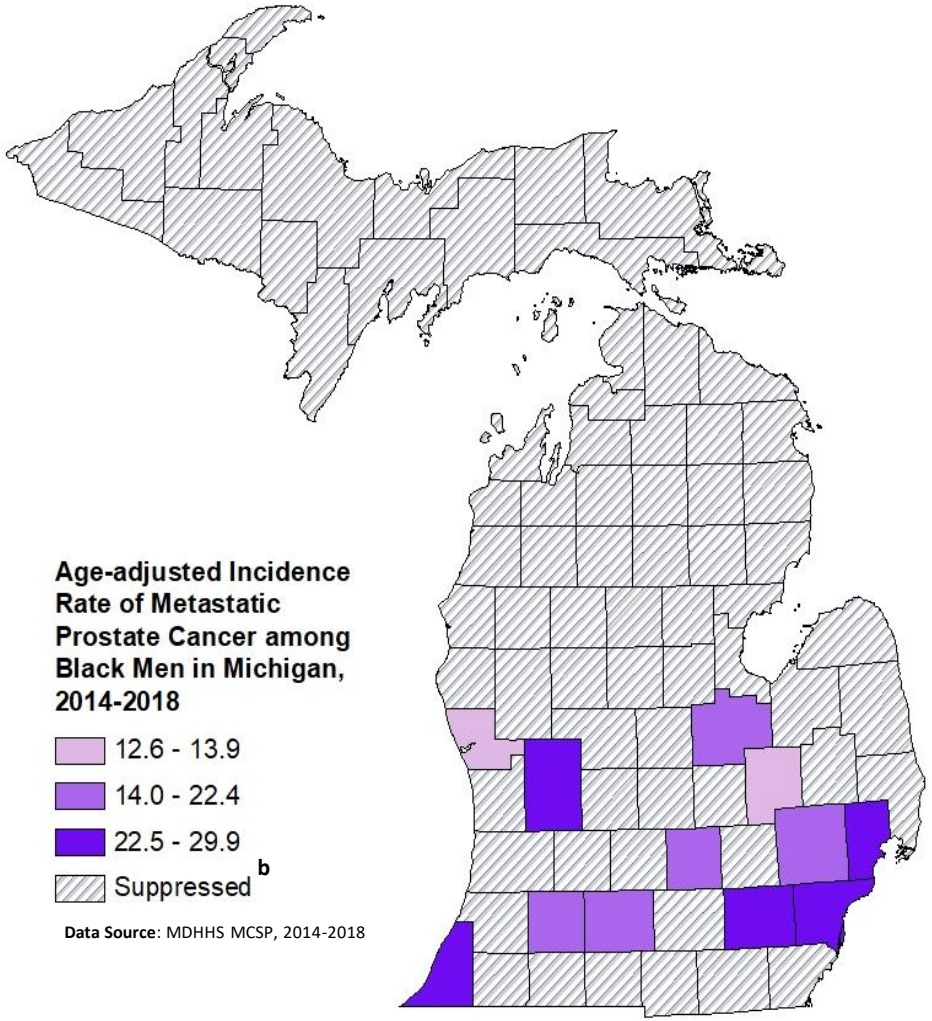
Metastatic Prostate Cancer Diagnosed in Michigan Men, 2014-2018

Between 2014 and 2018, data collected by the Michigan Cancer Registry estimated that approximately 29.3% of those diagnosed with prostate cancer had metastatic prostate cancer.



- The age-adjusted incidence rate for metastatic prostate cancer among white men in Michigan during this timeframe is 5.8 per 100,000 males.
- There were no counties in Michigan that had incidence rates for metastatic prostate cancer among white men that were considered outliers.

The age-adjusted incidence rate for metastatic prostate cancer in Michigan during this timeframe is 20.8 per 100,000 males.



- The age-adjusted incidence rate for metastatic prostate cancer among Black men in Michigan during this timeframe is 8.1 per 100,000 males.
- There were no counties in Michigan that had incidence rates for metastatic prostate cancer among Black men that were considered outliers.

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

Pancreatic Cancer in Michigan, 2014-2018

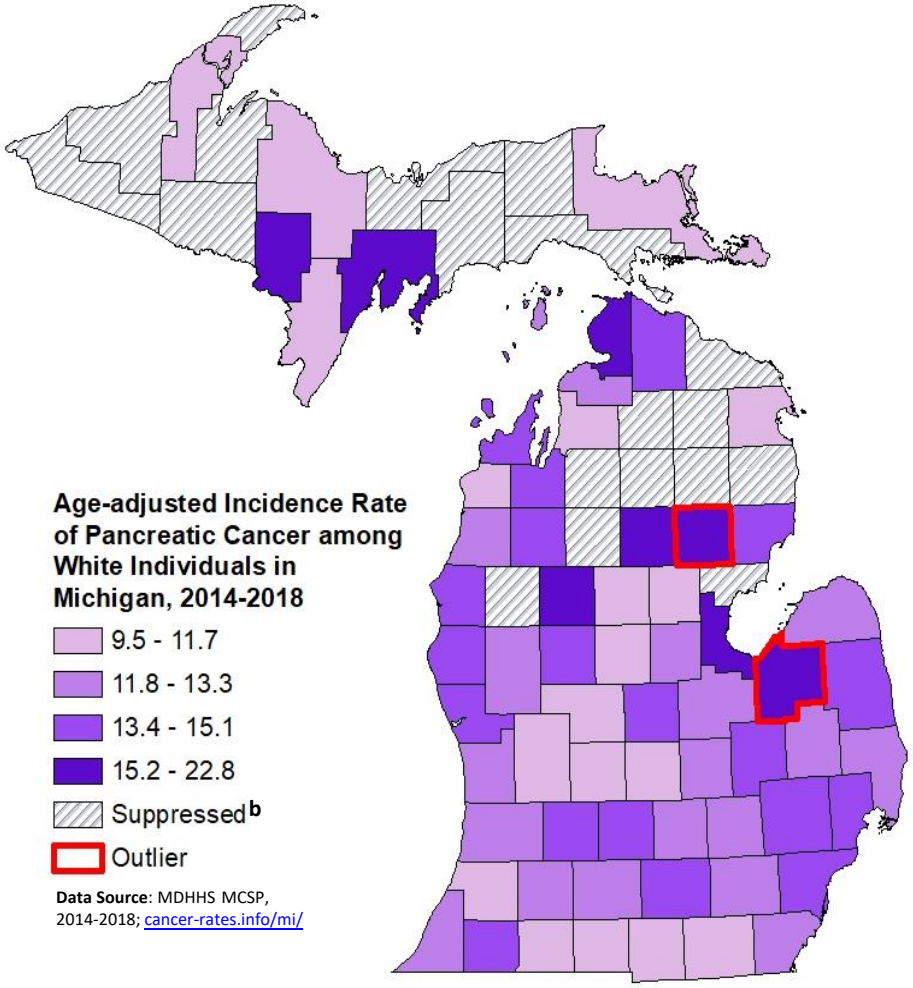
In the general population, the risk of pancreatic cancer is 1.6%.[17]

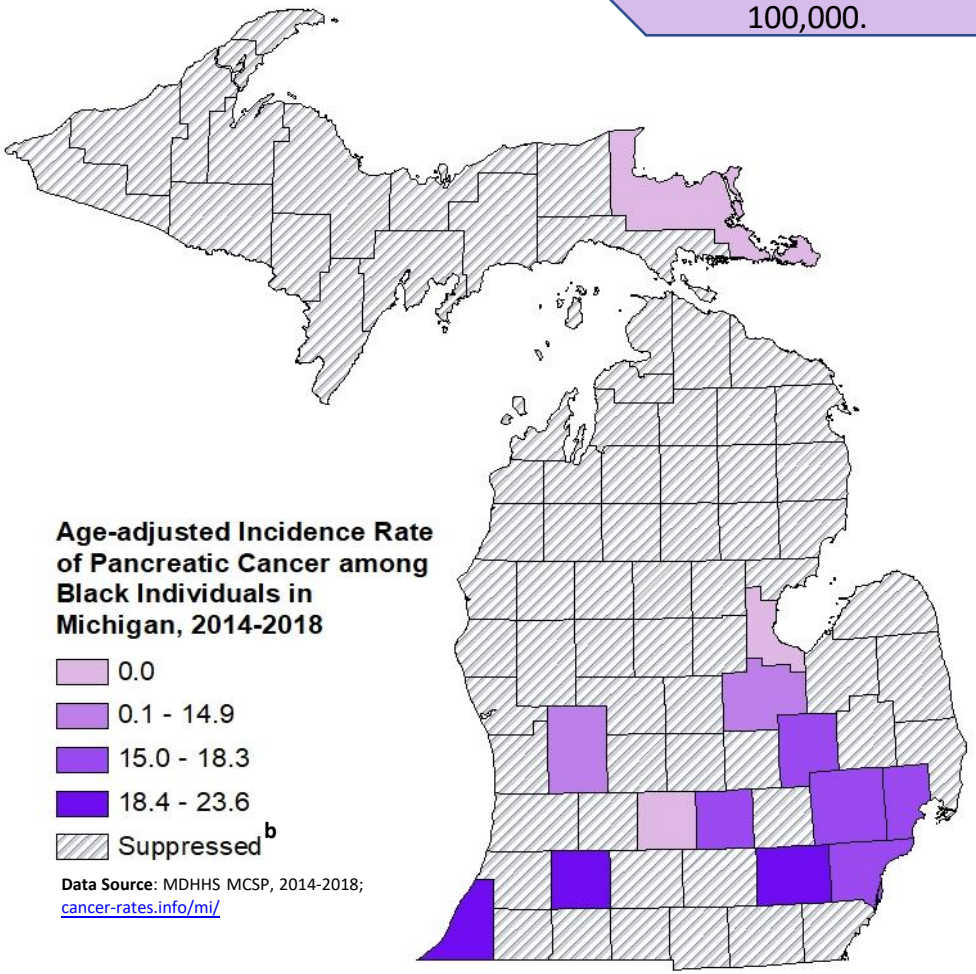
A *BRCA1* or *BRCA2* mutation increases the risk to 2.2-5.9%.[18]

Having a mutation in an MMR gene increases the risk to 8.8%.[18]

About 5-10% of pancreatic cancer is considered heritable.[18]

The age-adjusted incidence rate for pancreatic cancer in Michigan during this timeframe is 13.7 per 100,000.





- The age-adjusted incidence rate for pancreatic cancer in Michigan among white patients during this timeframe is 13.2 per 100,000.
- The counties that had an incidence rate that was considered outliers were:
  - Ogemaw
  - Tuscola
- One percent of white patients in the BRCA & HCN databases were diagnosed with pancreatic cancer.

- The age-adjusted incidence rate for pancreatic cancer among black patients in Michigan during this timeframe is 17.5 per 100,000.
- There were no counties in Michigan that had incidence rates for pancreatic cancer among Black patients that were considered outliers.
- One percent of Black patients in the BRCA & HCN databases were diagnosed with pancreatic cancer.

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

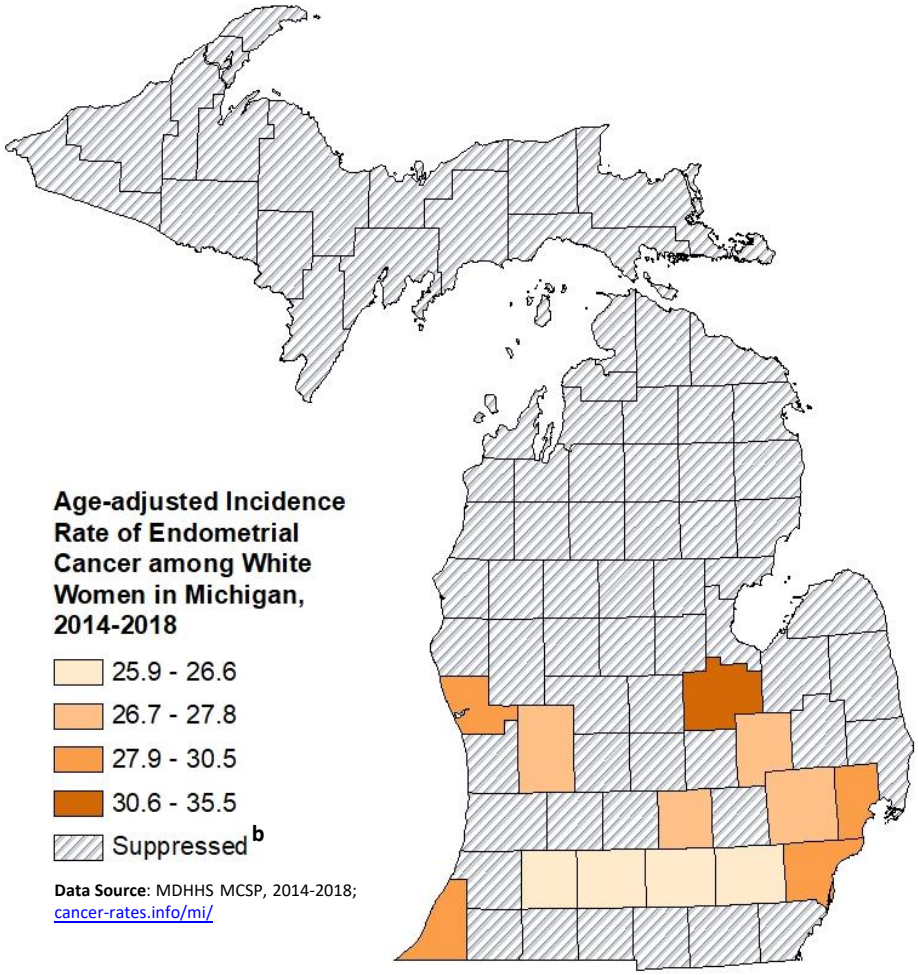
Endometrial Cancer Diagnosed in Michigan Women, 2014-2018

In the general population, the risk of endometrial cancer among women is 3.1%.[19]

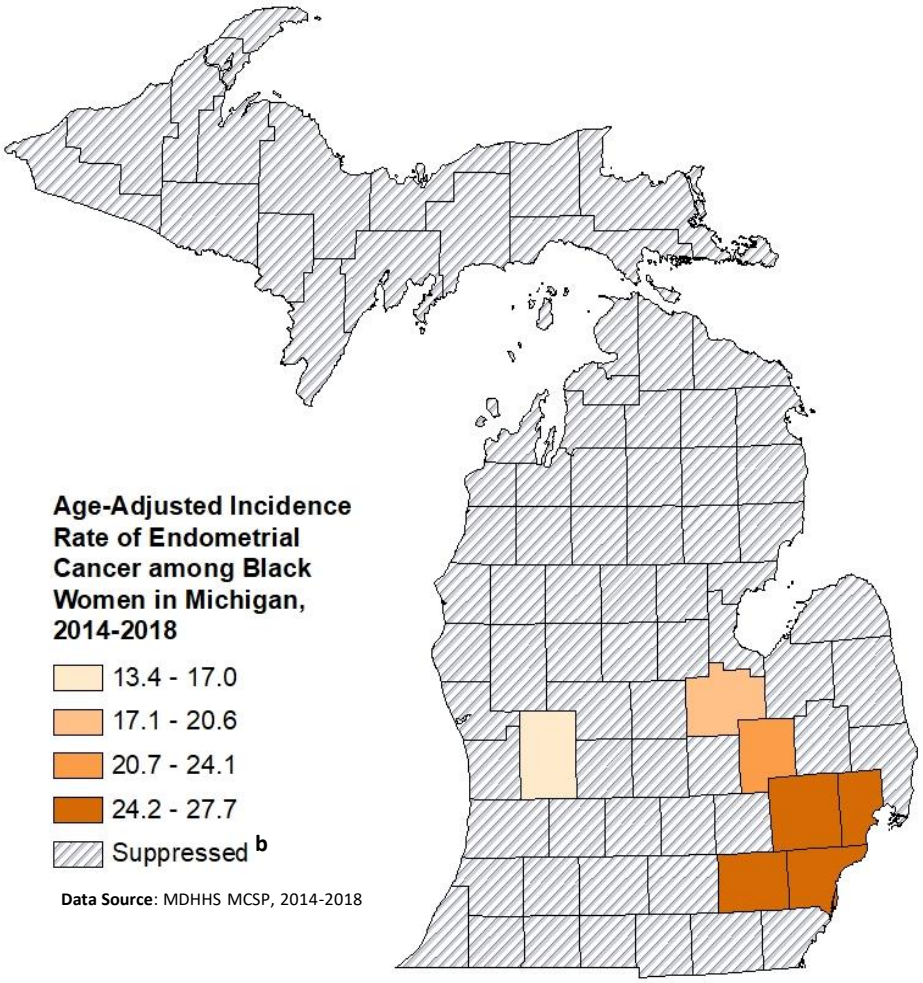
Lynch syndrome increases the risk to 25%-60%.[16]

About 2%-12% of endometrial cancer is considered heritable.[20]

The age-adjusted incidence rate for endometrial cancer in Michigan during this timeframe is 27.2 per 100,000 females.



- The age-adjusted incidence rate for endometrial cancer among white women in Michigan during this timeframe is 27.8 per 100,000 females.
- There were no counties in Michigan that had incidence rates for endometrial cancer among white patients that were considered outliers.
- Four percent of white patients in the BRCA & HCN databases were diagnosed with endometrial cancer, which was significantly higher than endometrial cancer among Black women.

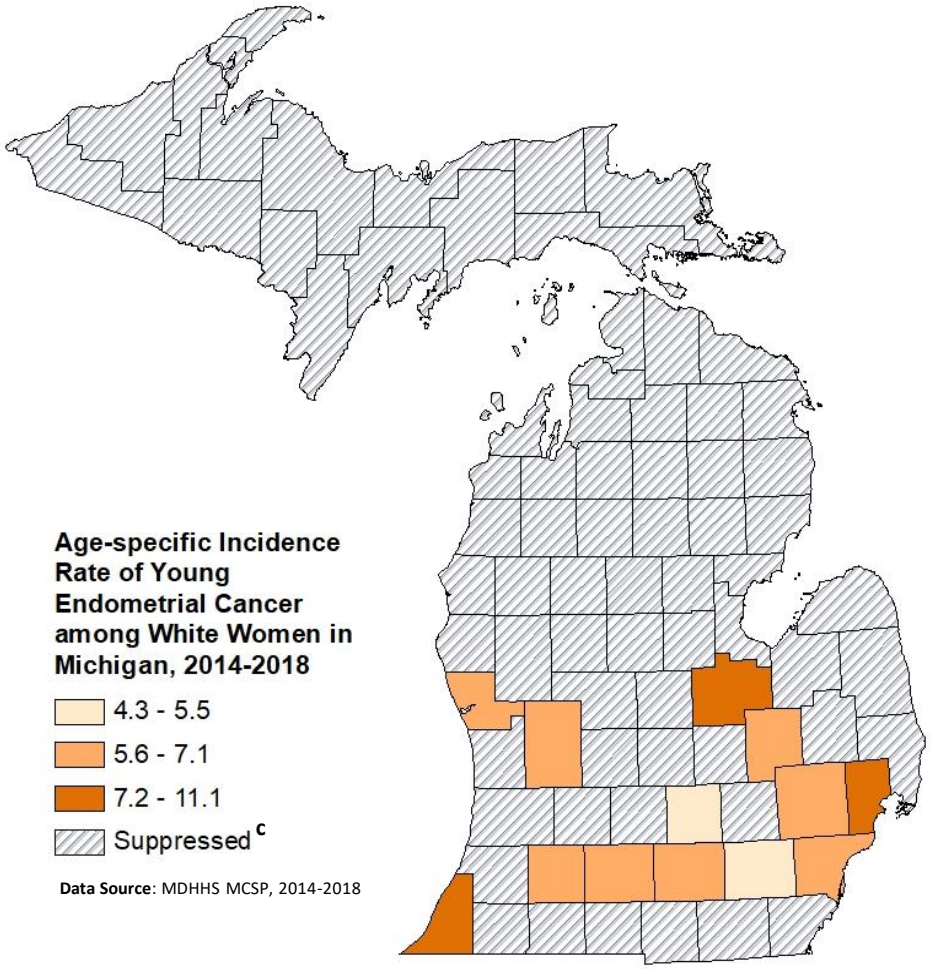


- The age-adjusted incidence rate for endometrial cancer among Black women in Michigan during this timeframe is 24.1 per 100,000 females.
- There were no counties in Michigan that had incidence rates for endometrial cancer among Black patients that were considered outliers.
- Two percent of Black patients in the BRCA & HCN databases were diagnosed with endometrial cancer.

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

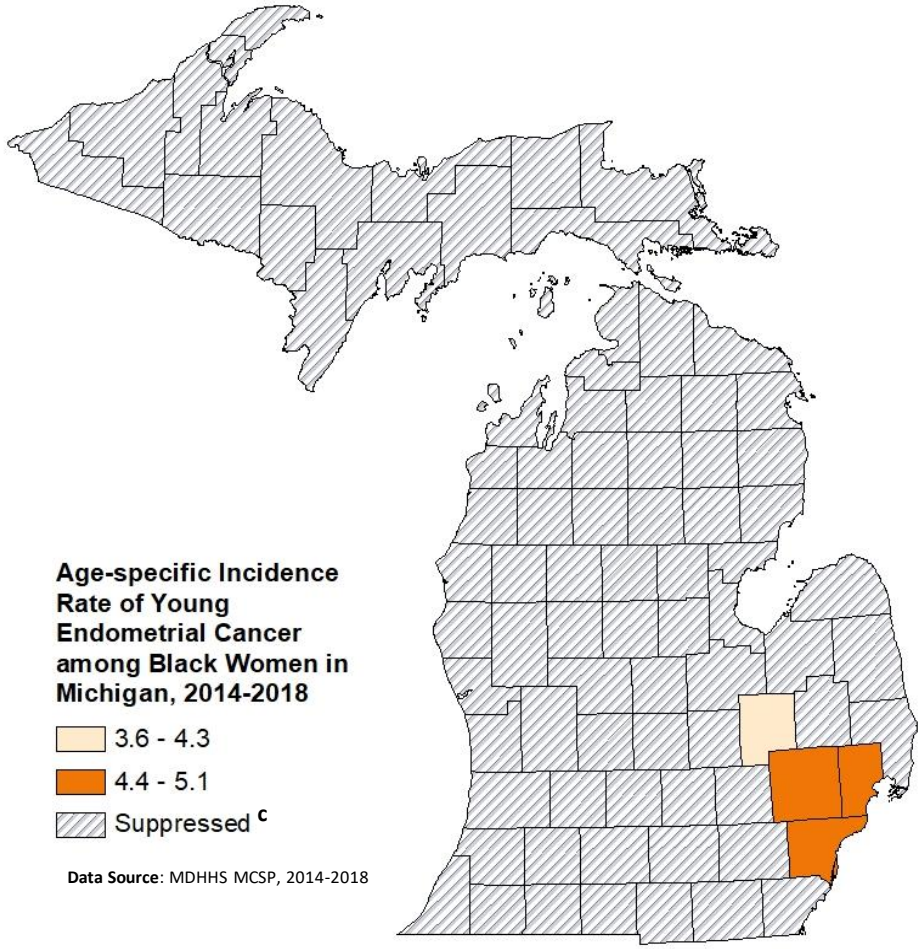
Young Endometrial Cancer (≤50 years old) Diagnosed in Michigan Women, 2014-2018

Approximately 11% of those who are diagnosed with endometrial cancer are diagnosed at or under the age of 50.[21]



- The age-specific incidence rate for endometrial cancer at age 50 or younger among white women in Michigan during this timeframe is 7.0 per 100,000 females, which is higher compared to Black women.
- There were no counties in Michigan that had incidence rates for endometrial cancer among white patients that were considered outliers.
- Of the white women diagnosed with endometrial cancer from the BRCA & HCN databases, 24.0% were diagnosed before the age of 50.

The age-specific incidence rate for endometrial cancer at age 50 or younger in Michigan during this timeframe is 6.6 per 100,000 females.

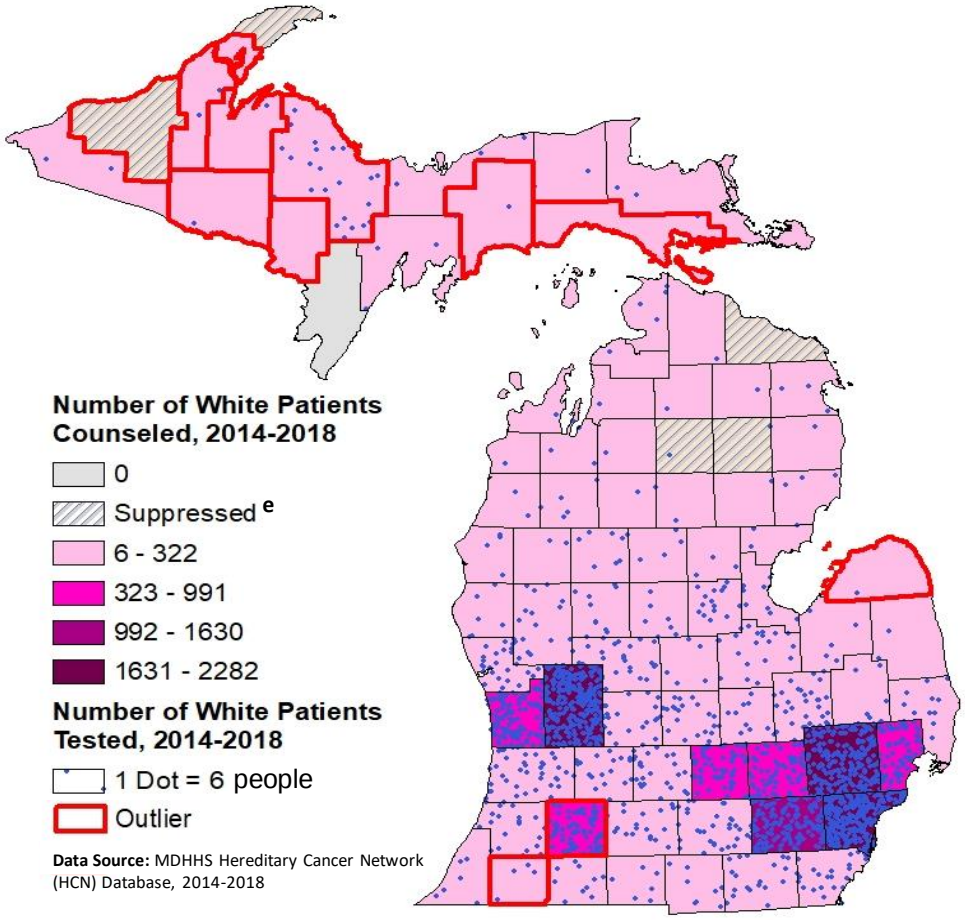


- The age-specific incidence rate for endometrial cancer at age 50 or younger among Black women in Michigan during this timeframe is 4.1 per 100,000 females.
- There were no counties in Michigan that had incidence rates for endometrial cancer among Black patients that were considered outliers.
- Of the Black women diagnosed with endometrial cancer from the BRCA & HCN databases, 24.2% were diagnosed before the age of 50.

[c] Numbers are suppressed for age-specific numerators less than six.

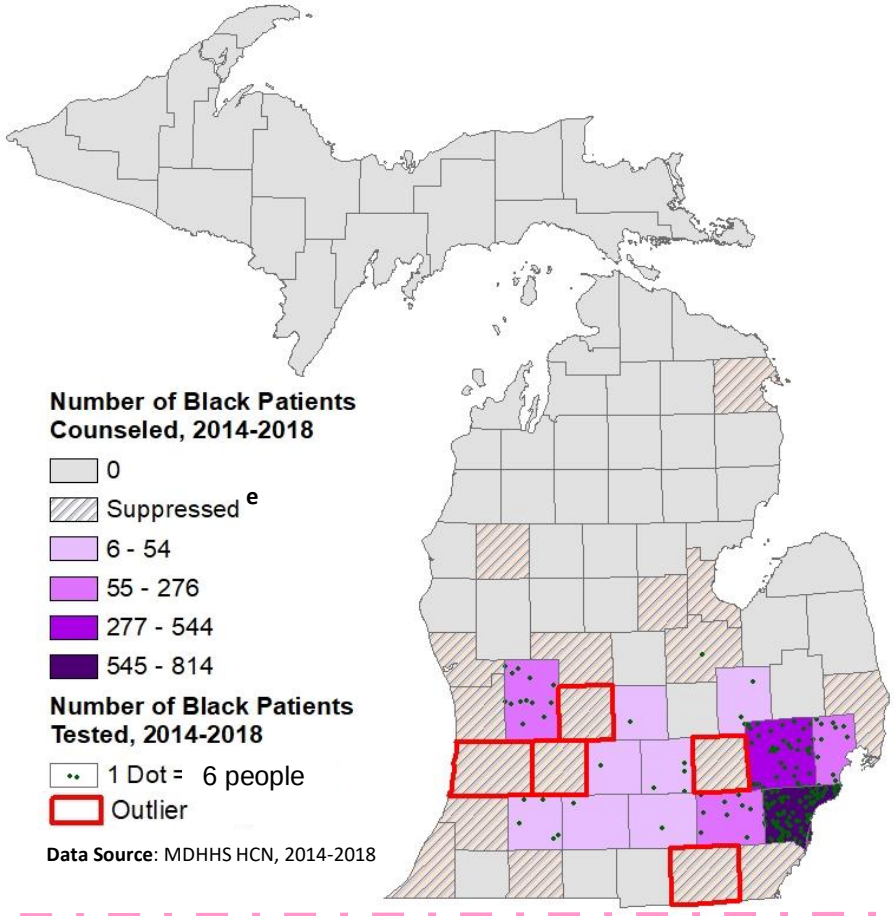
Genetic Counseling and Testing in Michigan from the HCN Database, 2014-2018

Approximately 18,976 patients received genetic counseling at one of the HCN partner clinics between 2014 and 2018.



- Approximately 15,854 white patients received genetic counseling at one of the HCN partner clinics between 2014 and 2018.
  - Of these, 11,557 (72.9%) white patients received genetic testing at one of the HCN partner clinics.
- Using data collected from the HCN database, 11 counties in Michigan had low rates of cancer genetic testing among white patients compared to the number of those who pursued cancer genetic counseling:
  - Baraga
  - Cass
  - Dickinson
  - Houghton
  - Huron
  - Kalamazoo
  - Mackinac
  - Marquette
  - Ontonagon
  - Schoolcraft
  - St. Joseph

Of these, 13,717 (72.3%) patients received genetic testing at one of the HCN partner clinics.



- Approximately 1,517 Black patients received genetic counseling at one of the HCN partner clinics between 2014 and 2018.
  - Of these, 1,074 (70.8%) Black patients received genetic testing at one of the HCN partner clinics.
- Using data collected from the HCN database, five counties in Michigan had low rates of cancer genetic testing among Black patients compared to the number of those who pursued cancer genetic counseling:
  - Allegan
  - Barry
  - Ionia
  - Lenawee
  - Livingston

[e] Data are suppressed if count is less than 6.

Summary

By analyzing the geographic distribution of specific cancers and genetic counseling by race, areas that need to be targeted for future interventions can be identified and tailored to the population that needs help.

Key Findings:

1. The following cancer types had counties that were considered outliers for cancer incidence rates:
   - **a. Colorectal Cancer**
     - i. White Michiganders: Kalkaska
     - ii. Black Michiganders: Berrien
   - **b. Young Colorectal Cancer**
     - i. Black Michiganders: Calhoun
   - **d. Pancreatic Cancer**
     - i. White Michiganders: Ogemaw and Tuscola
   - **e. Male Breast Cancer**
     - i. Black Michiganders: Wayne

2. While looking at cancer incidence rates between white and Black Michiganders, we see that there were some differences:
   - a. White Michiganders had a **higher** incidence rate compared to Black Michiganders for the following cancer types:
     - **i. Female breast cancer** (154.3 per 100,000 vs 120.2 per 100,000)
     - **ii. Young female breast cancer** (47.4 per 100,000 vs. 37.6 per 100,000)
     - **iii. Young endometrial cancer** (7.0 per 100,000 vs. 4.1 per 100,000)
   - b. Black Michiganders had a **higher** incidence rate compared to white Michiganders for the following cancer types:
     - **i. Colorectal cancer** (46.2 per 100,000 vs. 37.4 per 100,000)
     - **ii. Prostate cancer** (159.8 per 100,000 vs. 97.8 per 100,000)
     - **iii. Prostate cancer** with a Gleason Score of 7 or greater (106.7 per 100,000 vs. 60.0 per 100,000)

3. Eleven counties in Michigan had low rates of cancer genetic testing among white Michiganders compared to the number of those who pursued cancer genetic counseling:
   - Baraga
   - Cass
   - Dickinson
   - Houghton
   - Huron
   - Kalamazoo
   - Mackinac
   - Marquette
   - Ontonagon
   - Schoolcraft
   - St. Joseph

4. Five counties in Michigan had low rates of genetic testing among Black Michiganders compared to the numbers of those who pursued cancer genetic counseling:
   - Allegan
   - Barry
   - Ionia
   - Leenawee
   - Livingston

This analysis does have limitations. Genetic counseling by someone not board certified, or by a clinic not part of the HCN, or through 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.

As these cancers have a genetic component, MDHHS is considering strategies to encourage the collection of family health history through collaboration with local health departments. Sharing personal and family health history with a health care provider can help to prevent the disease or diagnose it at an early, treatable stage. Currently, there are resources available to assist providers in evaluating patient risk for hereditary cancers, such as Migrc.org/cancer-risk. If a patient should need referral for genetic services, MDHHS has developed a directory of genetics service providers within the state of Michigan, Migrc.org/Providers/Michigan Cancer Genetics Alliance/MCGA Directory of Cancer Genetic-Services Providers. Collecting family health history, including types of cancer, age of diagnosis and results of genetic tests are important for discussions with a health care provider.

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To Find More Information

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