

# Geographic Distribution of Select Hereditary Cancers and Genetic Services

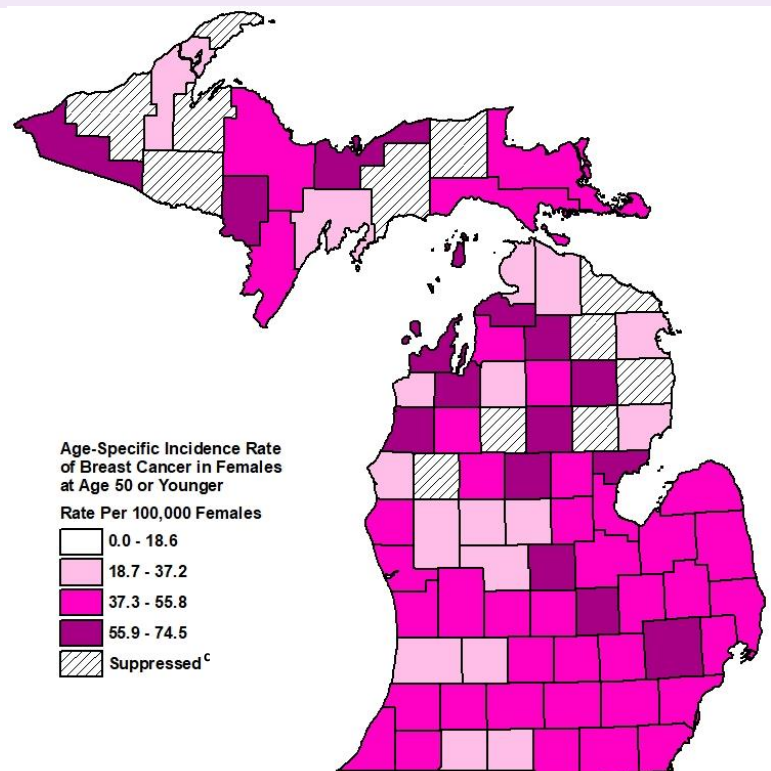
**Background:** Harmful mutations in the BReast CAncer, or *BRCA1* and *BRCA2* genes, substantially increase the risk of developing hereditary breast and ovarian cancers (HBOC) over the course of a lifetime. Additionally, a *BRCA1* or *BRCA2* mutation, the most common causes of HBOC, increases the risk 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 for colorectal, endometrial, and ovarian 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 personal history or strong family history of these cancers. Early identification of HBOC or LS can help reduce the impact of cancer and save 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 decisions for program planning. 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.

**Methods:** Data on the incidence rates of specific cancers are provided by the MCSP and include cases diagnosed in 2012-2016. 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 as a result of HBOC and LS. The number of patients receiving genetic counseling in Michigan is from the Hereditary Cancer Network Database (HCN). Eighteen clinics have contributed information to this database.<sup>a</sup> 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 counseling for HBOC or LS are included for the years 2012-2016 (N=17,269). In this report, outliers refer to counties with an incidence rate that is abnormally high. 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. Numbers are suppressed for counties with age-adjusted numerators less than 20 or for age-specific numerators less than six. Data suppression rules are applied as noted for the maps.<sup>b,c</sup>

<sup>a</sup> 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. Numbers are suppressed for counties with: <sup>b</sup>age-adjusted numerators less than 20. or for <sup>c</sup>age-specific numerators less than six.

## Young Breast Cancer ( $\leq 50$ years old) Diagnosed in Michigan Women, 2012-2016

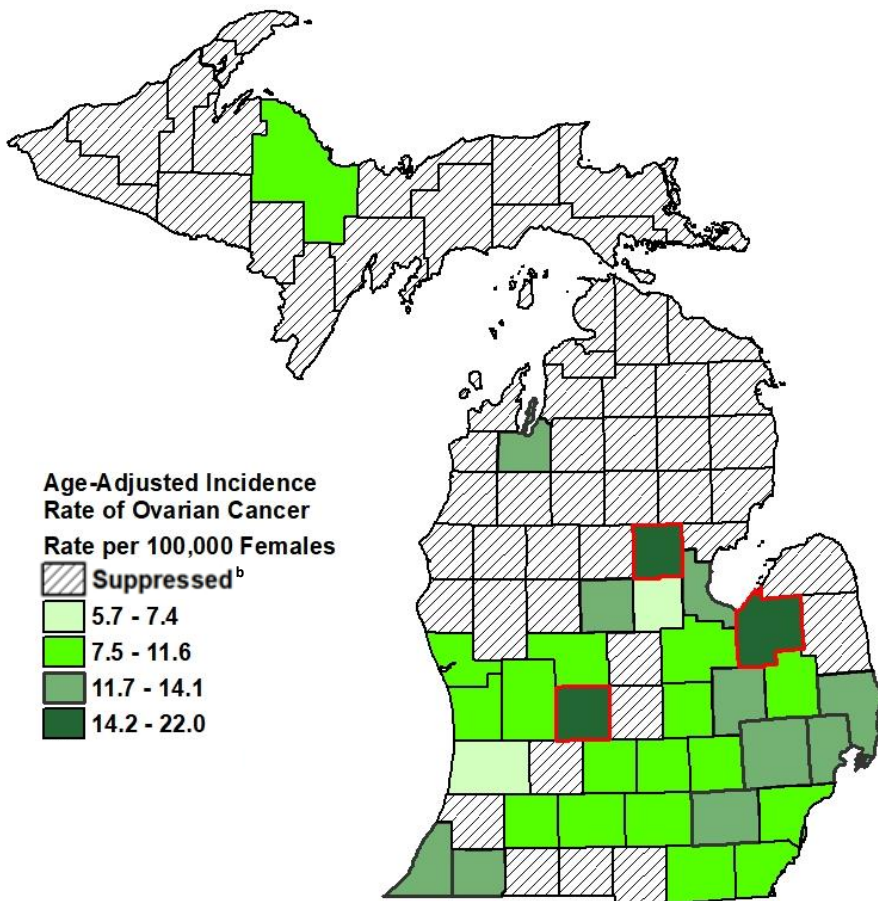
- In the general population, the risk of breast cancer is 12%.<sup>1</sup>
  - A *BRCA1* mutation increases the risk to 46%-87%.<sup>1</sup>
  - A *BRCA2* mutation increases the risk to 38%-84%.<sup>1</sup>
- About 10% of breast cancer is considered heritable.<sup>1</sup>
- The incidence rate for young female breast cancer in Michigan is 46.7 per 100,000 females.
- There were no counties in Michigan that had incidence rates for young breast cancer that were considered outliers.
- Among all patients in the HCN database, 47% were diagnosed with breast cancer.
  - Of those with breast cancer, 53% were diagnosed with breast cancer at age 50 or younger.



**Data Source:** Michigan Department of Health and Human Services (MDHHS) Michigan Cancer Surveillance Program (MCSP), 2012-2016

## Ovarian Cancer Diagnosed in Michigan Women, 2012-2016

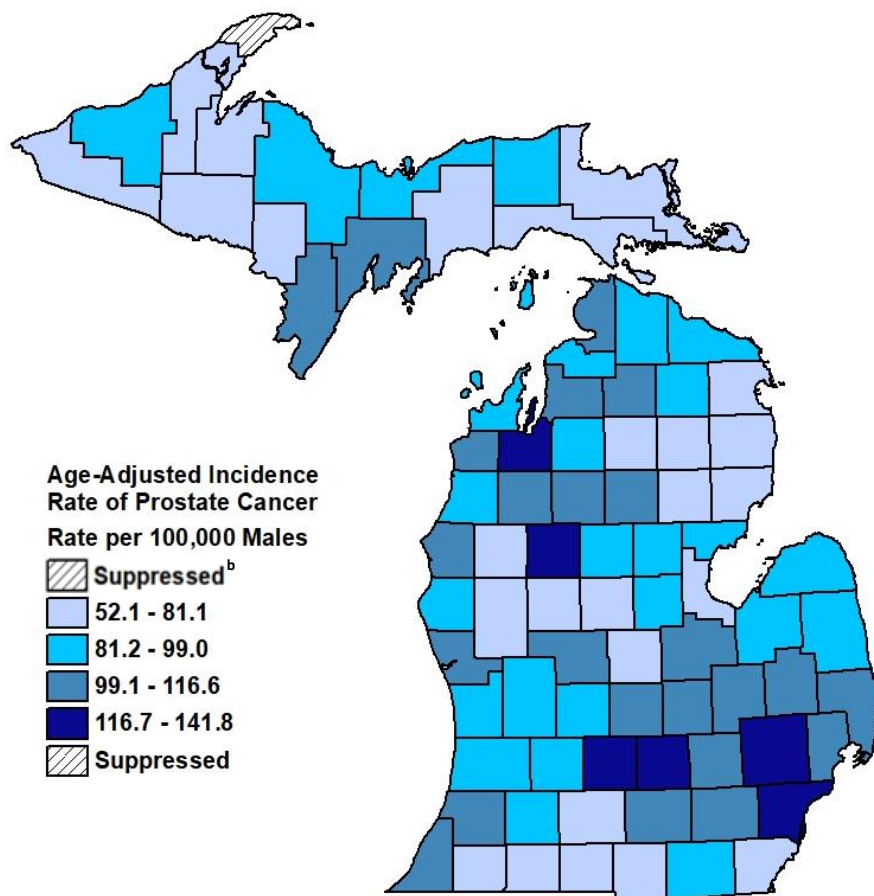
- In the general population, the risk of ovarian cancer is 1.3%.<sup>1</sup>
  - A *BRCA1* mutation increases the risk to 39%.<sup>1</sup>
  - A *BRCA2* mutation increases the risk to 11%-17%.<sup>1</sup>
  - Having Lynch syndrome increases one's risk to 10%-12%.<sup>2</sup>
- About 15% of ovarian cancers are considered heritable.<sup>1</sup>
- The age-adjusted incidence for ovarian cancer in Michigan is 11.4 per 100,000 females.
- The counties that have incidence rates that are outliers are (red outline):
  - Gladwin
  - Ionia
  - Tuscola
- Five percent of patients in the HCN database were diagnosed with ovarian cancer.



Data Source: MDHHS MCSP, 2012-2016

## Prostate Cancer Diagnosed in Michigan Men, 2012-2016

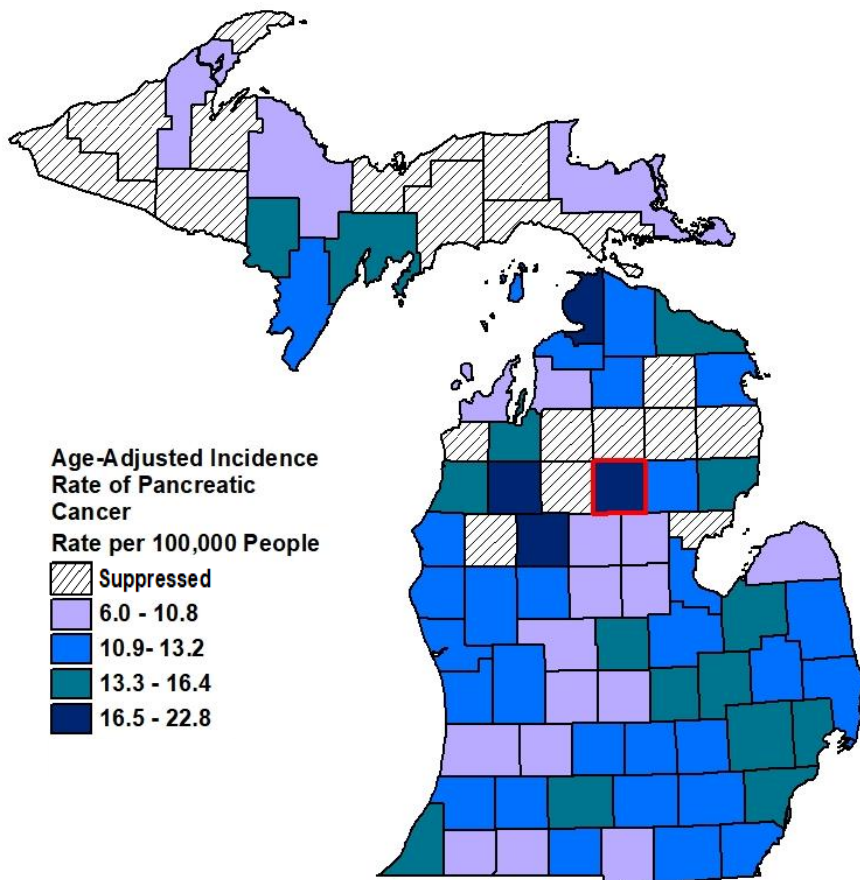
- In the general population, the risk of prostate cancer is 15%.<sup>1</sup>
  - A *BRCA2* mutation increases the risk to 20%.<sup>1</sup>
- About 5%-10% of prostate cancer is considered heritable.<sup>3</sup>
- Having a prostate cancer with a Gleason score of 7 or greater indicates the cancer is aggressive and may be a sign of a *BRCA1/2* mutation.<sup>4</sup>
- The age-adjusted incidence for prostate cancer with a Gleason Score of 7 or greater in Michigan is 70.1 per 100,000 males (data not shown).
- There were no counties in Michigan that had incidence rates for prostate cancer that were considered outliers.
- One percent of patients in the HCN database were diagnosed with prostate cancer and of those with prostate cancer, 16% had a Gleason Score of 7 or greater.



Data Source: MDHHS MCSP, 2012-2016

# Pancreatic Cancer in Michigan, 2012-2016

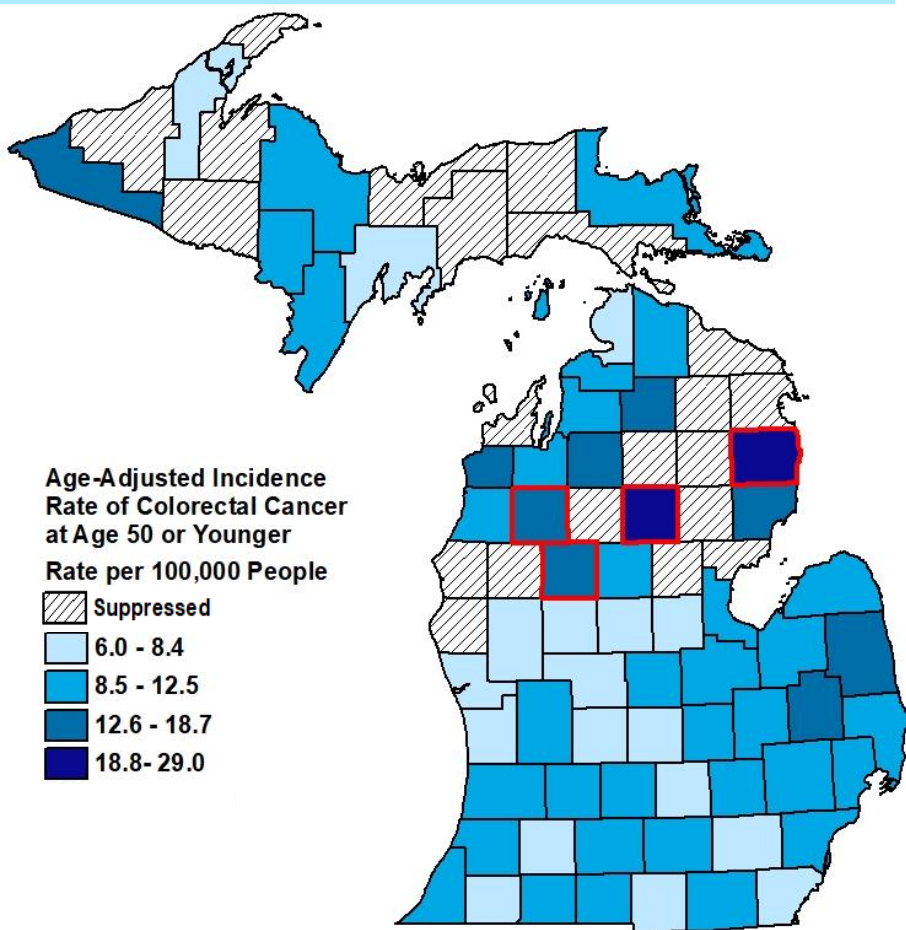
- In the general population, the risk of pancreatic cancer is 1.5%.<sup>1</sup>
  - A *BRCA2* mutation increases the risk to 2%-7%.<sup>1</sup>
- About 10% of pancreatic cancer is considered heritable.<sup>3</sup>
- The age-adjusted incidence for pancreatic cancer in Michigan is 13.3 per 100,000.
- The only county that had an incidence rate that was an outlier was (red outline) Roscommon.
- One percent of patients in the HCN database were diagnosed with pancreatic cancer.



Data Source: MDHHS MCSP, 2012-2016

# Young Colorectal Cancer (≤50 years old) in Michigan, 2012-2016

- In the general population, the risk of colorectal cancer is 15%.<sup>1</sup>
  - Lynch syndrome increases the risk to 80%.<sup>5</sup>
- About 5%-10% of colorectal cancer is considered heritable.<sup>6</sup>
- The age-specific incidence for colorectal cancer at age 50 or younger in Michigan is 9.4 per 100,000.
- The counties that have incidence rates that are outliers are (red outline):
  - Roscommon
  - Alcona
  - Osceola
  - Wexford
- Three percent of patients in the HCN database were diagnosed with colorectal cancer.
  - Of those diagnosed with colorectal cancer, 49% were diagnosed before age 50.

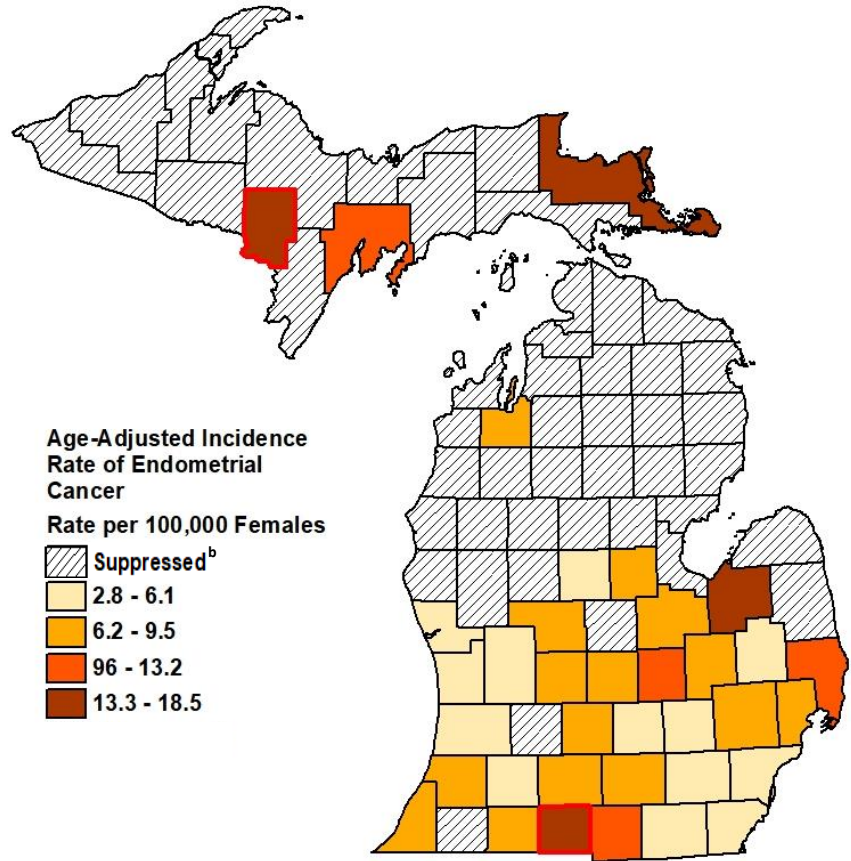


Data Source: MDHHS MCSP, 2012-2016



# Endometrial Cancer Diagnosed in Michigan Women, 2012-2016

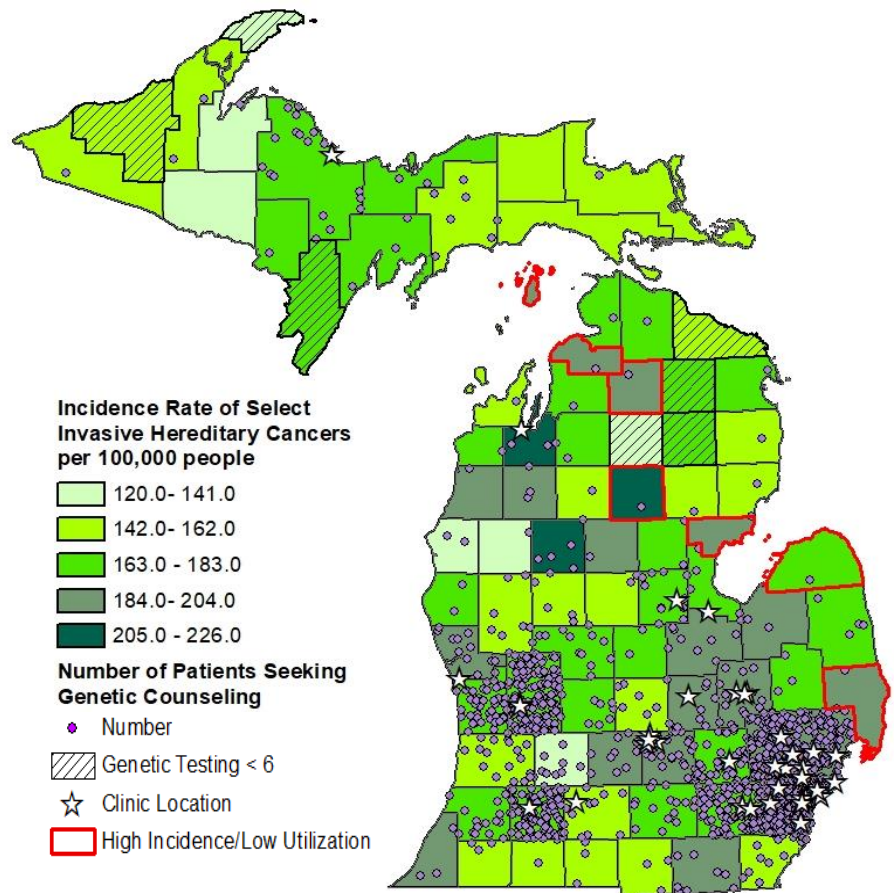
- In the general population the risk of endometrial cancer is 2.8%.<sup>7</sup>
  - Lynch syndrome increases the risk to 25%-60%.<sup>7</sup>
- About 2%-5% of endometrial cancer is considered heritable.<sup>7</sup>
- The age-specific incidence for endometrial cancer at age 50 or younger in Michigan is 6.5 per 100,000 females.
- The counties that have incidence rates that are outliers are (red outline):
  - Branch
  - Dickinson
- Two percent of patients in the HCN database were diagnosed with endometrial cancer.
  - Of those diagnosed with endometrial cancer, 32% were diagnosed before age 50.



Data Source: MDHHS MCSP, 2012-2016

# Genetic Counseling from the Hereditary Cancer Network, 2012-2016

- Approximately 17,269 patients received genetic counseling at one of the HCN partner clinics between 2012 and 2016.
- From the HCN database, residents from counties in Northern Michigan and the thumb area appear to have the lowest utilization of cancer genetic services.
- Six counties have a high need for genetic counseling<sup>d</sup> but have few residents utilizing genetic counseling services<sup>e</sup>, as reported by clinics in the HCN.
  - Arenac
  - Charlevoix
  - Huron
  - Otsego
  - Roscommon
  - St. Clair



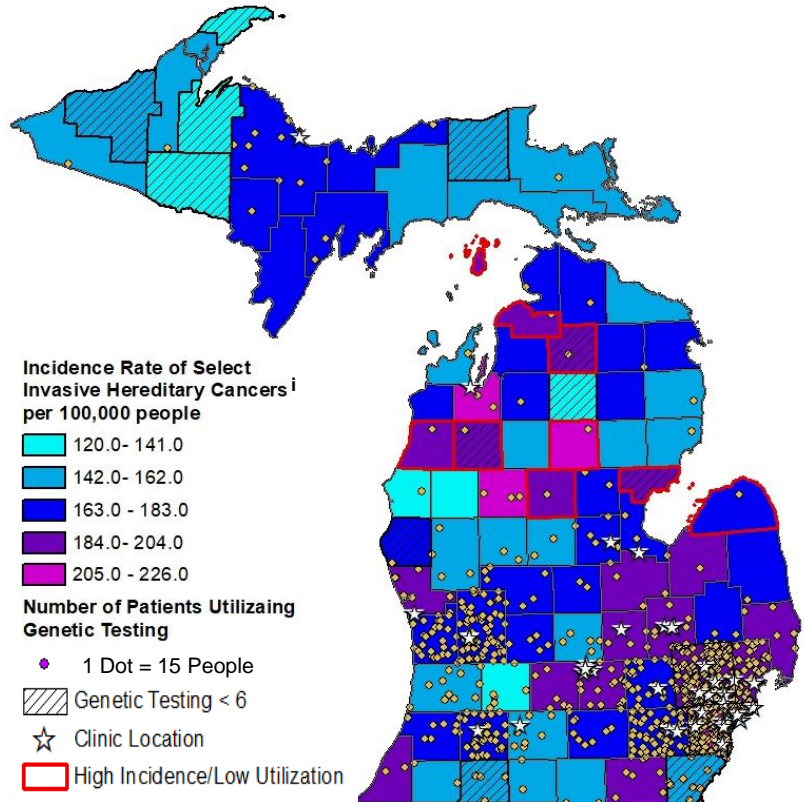
Data Sources: MDHHS MCSP, 2012-2016

MDHHS Hereditary Cancer Network (HCN) Database, 2012-2016

<sup>d</sup> High need for genetic counseling is defined as having an incidence rate greater than 183.0 per 100,000 people. <sup>e</sup> Low utilization is defined as less than 20 people per county receiving genetic counseling services. <sup>f</sup> Select invasive hereditary cancers are cancers of the colon, rectum, endometrium, breast, ovary, pancreas, and prostate gland.

# Genetic Testing from the Hereditary Cancer Network, 2012-2016

- Approximately 10,853 patients received genetic testing at one of the HCN partner clinics between 2012 and 2016.
- From the HCN database, residents from counties in Northern Michigan, North Central Michigan, and the thumb area appear to have the lowest utilization of cancer genetic services.
- Eight counties have a high need for genetic testing<sup>g</sup> but have few residents utilizing genetic testing services<sup>h</sup>, as reported by clinics in the HCN.
  - Arenac
  - Charlevoix
  - Clare
  - Huron
  - Manistee
  - Otsego
  - Roscommon
  - Wexford



**Data Sources:** MDHHS MCSP, 2012-2016  
MDHHS Hereditary Cancer Network (HCN) Database, 2012-2016

<sup>g</sup> High need for genetic counseling is defined as having an incidence rate greater than 183.0 per 100,000 people. <sup>h</sup> Low utilization is defined as less than 20 people per county receiving genetic testing services. <sup>i</sup> Select invasive hereditary cancers are cancers of the colon, rectum, endometrium, breast, ovary, pancreas, and prostate gland.

## 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. There are six counties that have an overall high burden for possible hereditary cancer but are in the bottom quarter for residents seeking genetic counseling services. These same six counties, with an additional two counties, are also 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 network, or by a home genetic test is 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.

### For More Information:

Visit [www.Michigan.gov/hereditarycancer](http://www.Michigan.gov/hereditarycancer) to learn more about hereditary cancers

Visit [www.Michigan.gov/cge](http://www.Michigan.gov/cge) to view more data on hereditary cancers

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