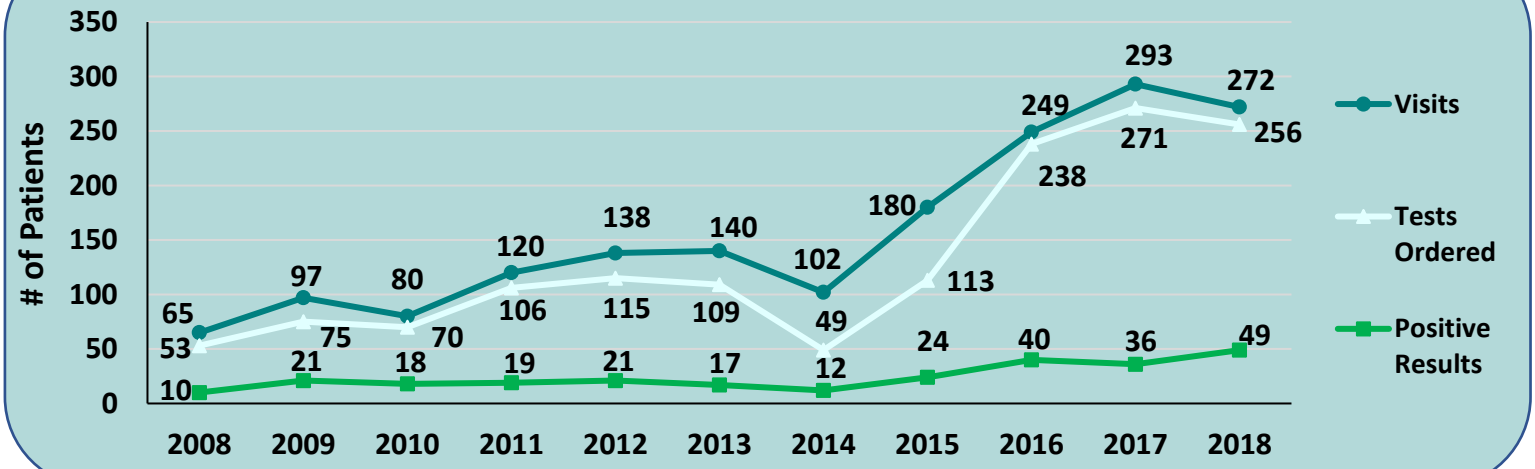
Ovarian Cancer Surveillance Status Report, 2008-2018

Background: Ovarian cancer is the second most common gynecologic cancer in the United States and causes more deaths than any other cancer of the female reproductive system.[1] In Michigan, there were 606 cases reported in 2017, with an incidence rate of 9.3 per 100,000.[2] There were 441 ovarian cancer deaths in Michigan in 2017, with a mortality rate of 6.3 per 100,000.[2] In the general population, the risk of ovarian cancer is 0.7%.[3] However, about 18% of ovarian cancers are considered heritable.[4] Mutations can raise a person's risk for ovarian cancer, especially mutations *BRCA1* and *BRCA2* genes, and those associated with Lynch syndrome (*MLH1*, *MSH2*, *MSH6*, *EPCAM*, and *PMS2*).[5] A *BRCA1* mutation increases the risk to 16-68%. A *BRCA2* mutation increases the risk to 11%-30%. A mutation in a gene associated with Lynch syndrome (*MLH1, MSH2, MSH6, EPCAM, and PMS2*) increases one's risk to 4-12%.[7] The National Comprehensive Cancer Network (NCCN) recommends that anyone with an ovarian cancer diagnosis, regardless of age, receive genetic counseling and testing to determine if their cancer is hereditary.[8]

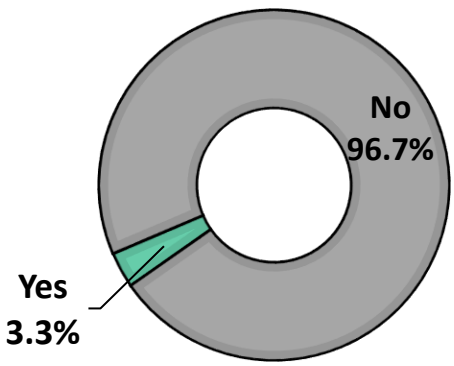
Methods: The following data were collected from the Michigan Department of Health and Human Services (MDHHS) BRCA Clinical Network (BRCA) and Hereditary Cancer Network (HCN) databases between **January 1, 2008, and December 31, 2018**. **During this time-frame, there were 1,736 individuals who were diagnosed with ovarian cancer**. The BRCA and HCN are unique databases that function as statewide surveillance networks for tracking the use of cancer genetic counseling and testing services for 19 actionable genes that are associated with Hereditary Breast and Ovarian Cancer (HBOC) and Lynch syndrome (LS) cancers in Michigan. In order to be eligible to be entered into the database, patients must have received genetic counseling from one of the clinics that have partnered with the MDHHS*, which means data may not be representative of Michigan's ovarian cancer population. Frequencies and chi-square analyses were performed between breast and ovarian cancer patients since both these types of patients are at risk for HBOC using SAS 9.4. Significant values were set at p <0.05. Data on breast cancer cases are not shown due to space.

Please contact Jessica Fritzler at FritzlerJ1@Michigan.gov for any questions.

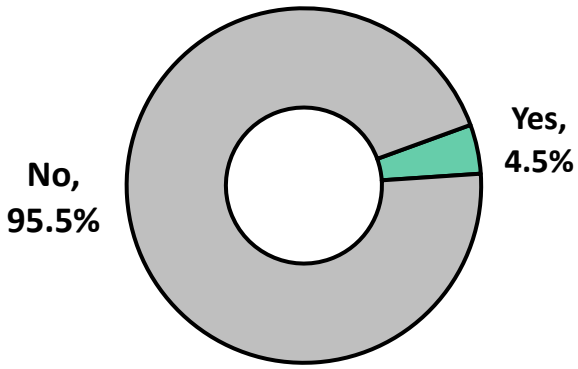
Visits and Genetic Testing, 2008-2018



Known Familial Mutation, 2008-2018

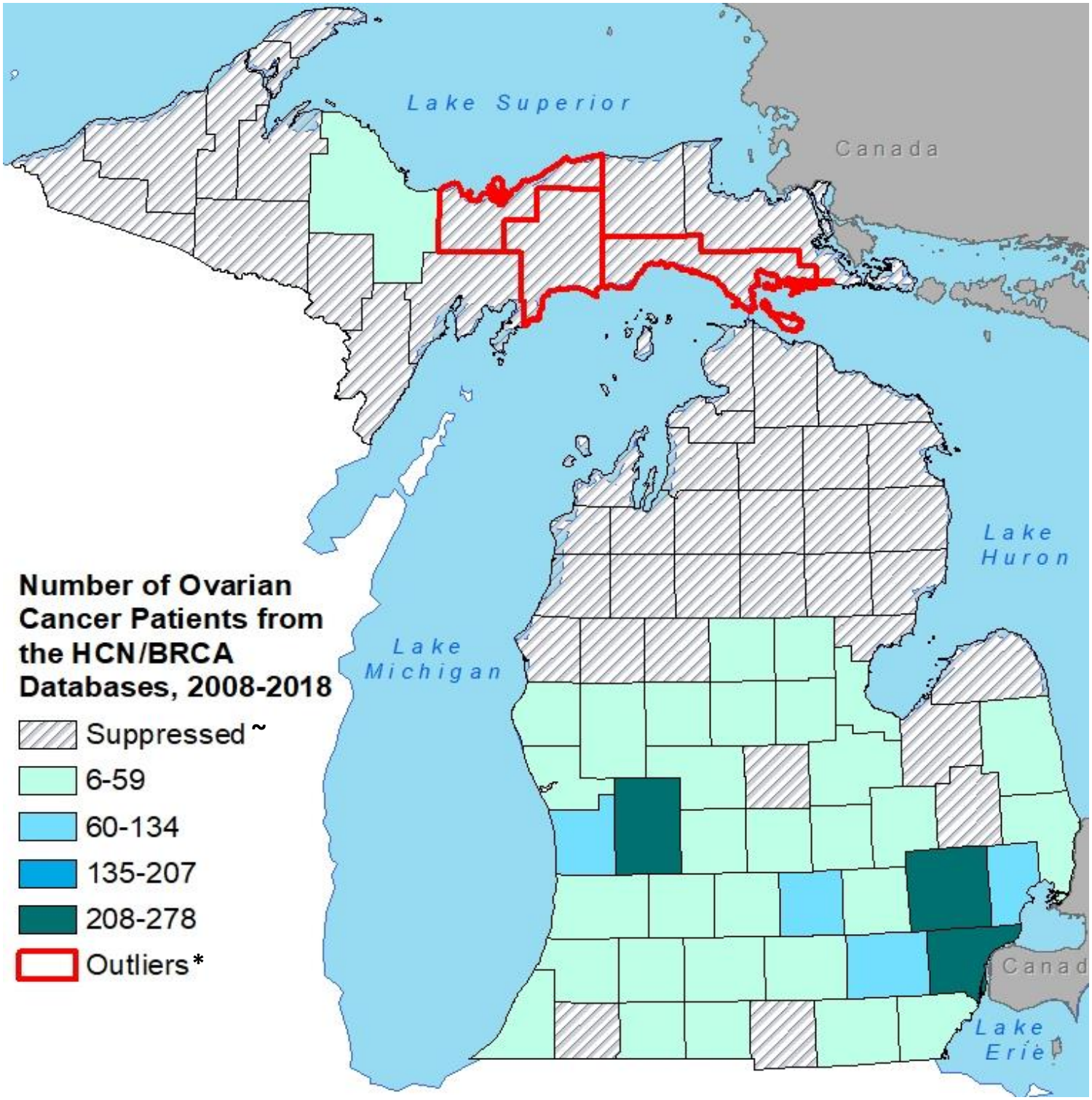


Ashkenazi Jewish, 2008-2018



* Clinical Partners: 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. ~ Data are suppressed if count is less than 6.

Ovarian Cancer Surveillance Status Report, 2008-2018

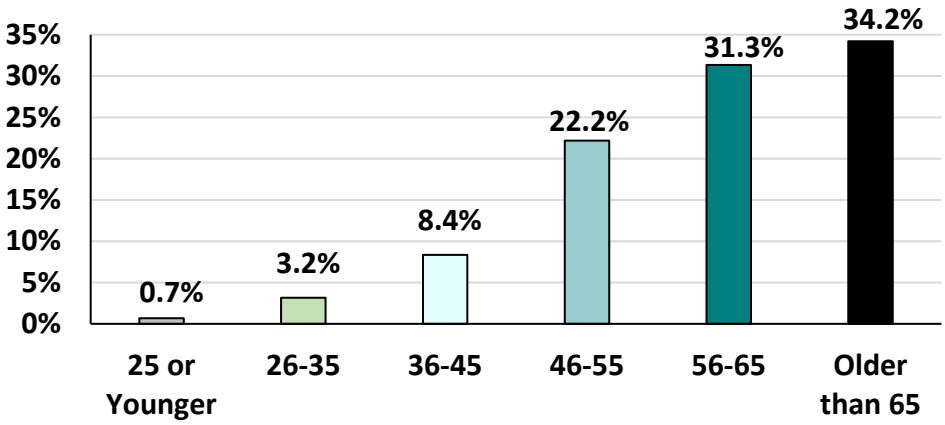


- Most ovarian cancer patients from the HCN live in Wayne County, followed by Oakland and Kent counties.
- Out of the 70 counties where ovarian cancer patients reside, 8 (11.4%) had genetic testing uptake rates below 75%.

~ Data are suppressed if count is less than 6. *Outliers refer to counties where the genetic testing rate is less than 65.9%, which is calculated by using the formula: Q3 - (IQR*1.5), where Q3 refers to the third quartile, and IQR refers to the interquartile range (Q3-Q1).

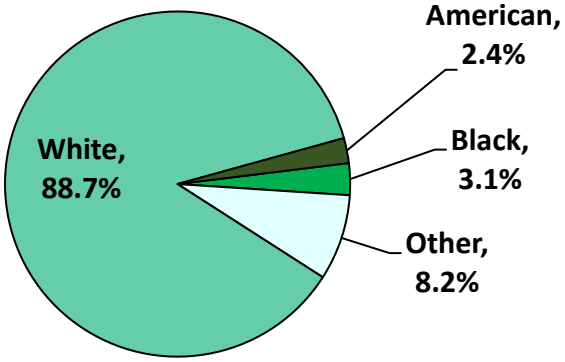
Ovarian Cancer Surveillance Status Report: Demographics, 2008-2018

Age at First Visit, 2008-2018

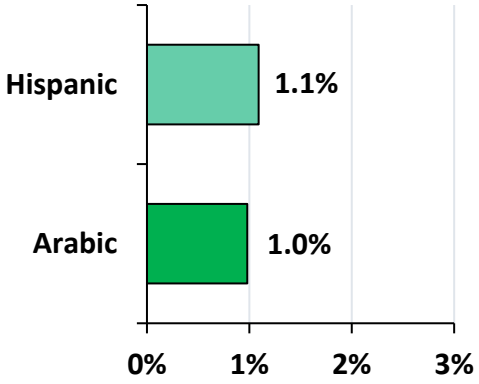


Ovarian cancer patients were less likely to be age 50 or younger compared to those with breast cancer (**23.8% vs. 37.8%**); data not shown.

Race, 2008-2018

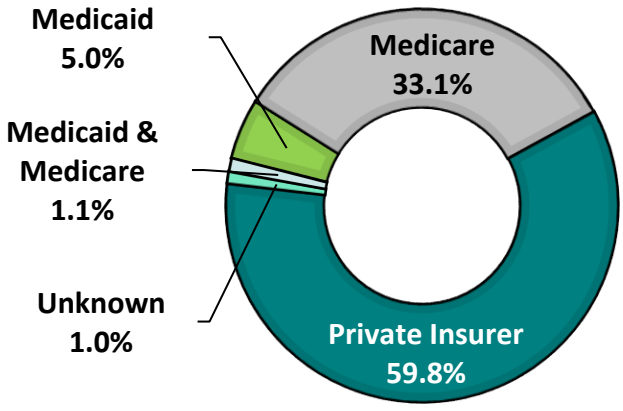


Ethnicity, 2008-2018



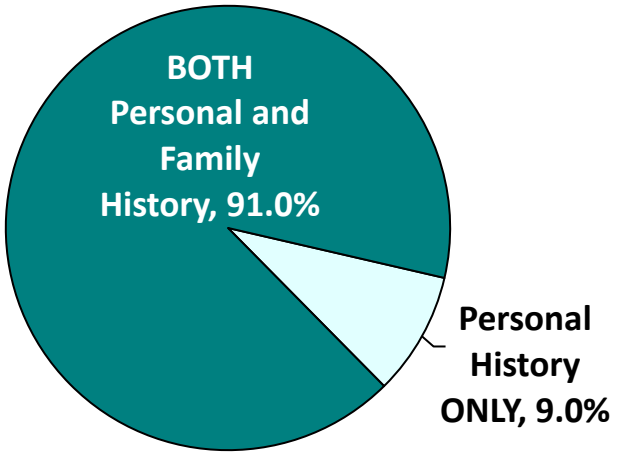
Those with breast cancer were more likely to identify as Black compared to those with ovarian cancer (**9.0% vs. 2.8%; data not shown**).

Insurance, 2008-2018



Ovarian cancer patients were more likely to have Medicare compared to those with breast cancer (**32.7% vs. 21.8%**; data not shown).

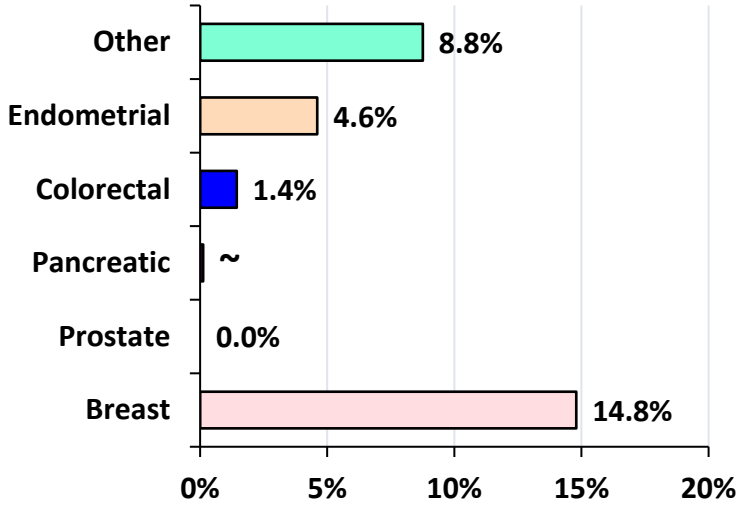
History of Cancer, 2008-2018



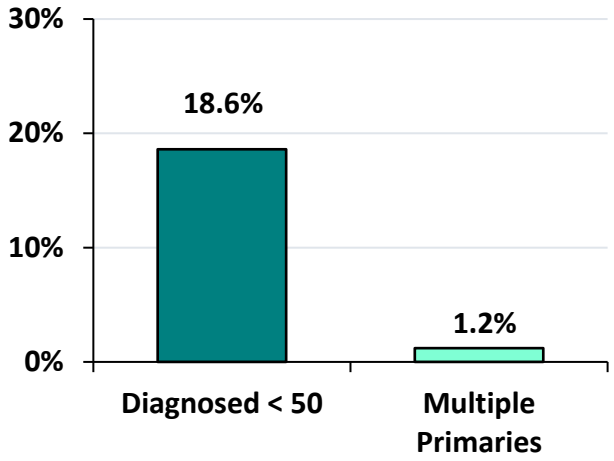
There were no differences in history of cancer between those with ovarian and breast cancer; data not shown.

Ovarian Cancer Surveillance Status Report: History of Cancer, 2008-2018

Type of Cancer among Ovarian Cancer Patients, 2008-2018

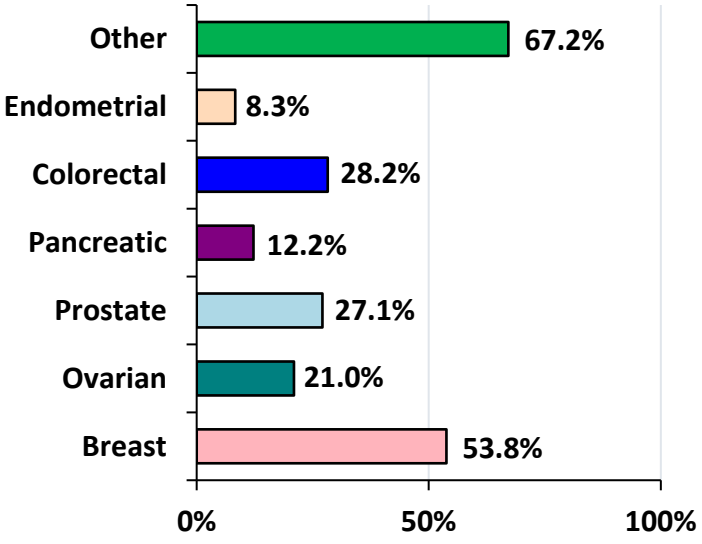


Ovarian Cancer Characteristics, 2008-2018

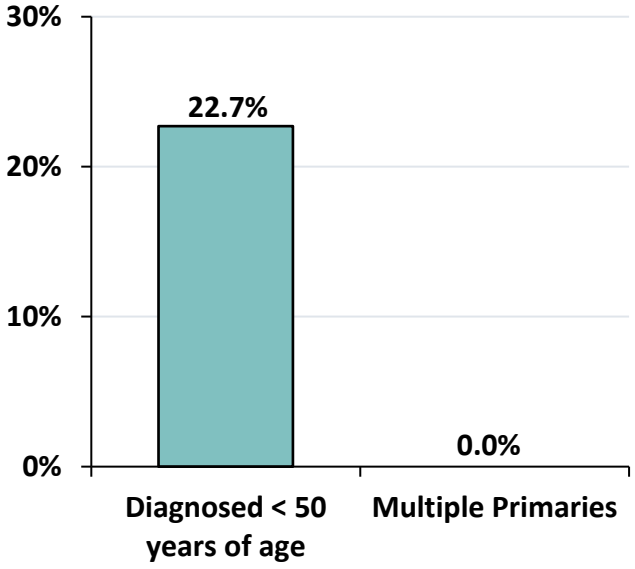


- **14.8%** of ovarian cancer patients were also diagnosed with breast cancer.

Type of Cancer among Family Members, 2008-2018



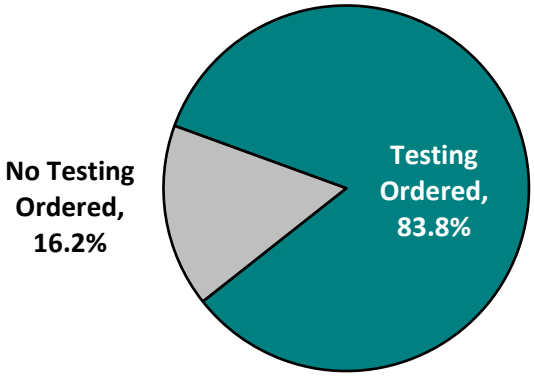
Ovarian Cancer among Relatives, 2008-2018



- Breast cancer patients were more likely to have a relative diagnosed with breast cancer compared to those diagnosed with ovarian cancer (**69.6% vs. 53.8%; data not shown)**.
- Ovarian cancer patients were more likely to have a relative diagnosed with the following cancer compared to breast cancer patients (data not shown):
  - Endometrial cancer (**8.3% vs. 7.2%**).
  - Ovarian cancer (**21.0% vs. 14.9%**).
- **11.9%** of these patients have a family history of both breast and ovarian cancer (data not shown).
  - Ovarian cancer patients were more likely to have a relative diagnosed with both breast and ovarian cancer compared to those with breast cancer (**11.9% vs. 9.3%; data not shown**).

Ovarian Cancer Surveillance Status Report: Genetic Testing, 2008-2018

Genetic Testing among Ovarian Cancer Patients, 2008-2018

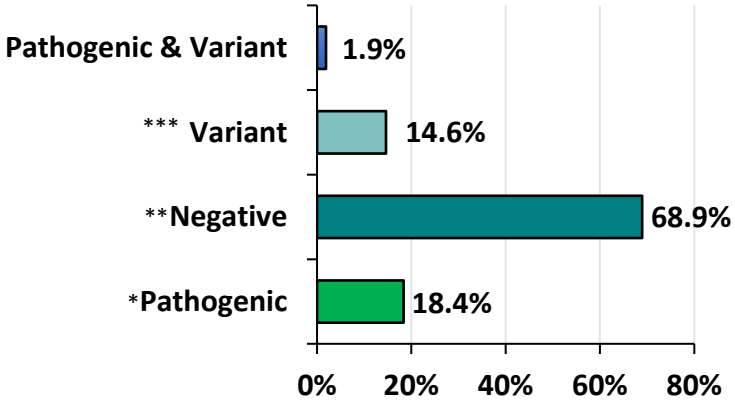


1.8% had testing prior to counseling.

3.1% had Single Site Testing.

Ovarian cancer patients were more likely to receive genetic testing compared to those with breast cancer (**83.8% vs. 78.5%; data now shown**).

Genetic Test Results among Ovarian Cancer Patients, 2008-2018

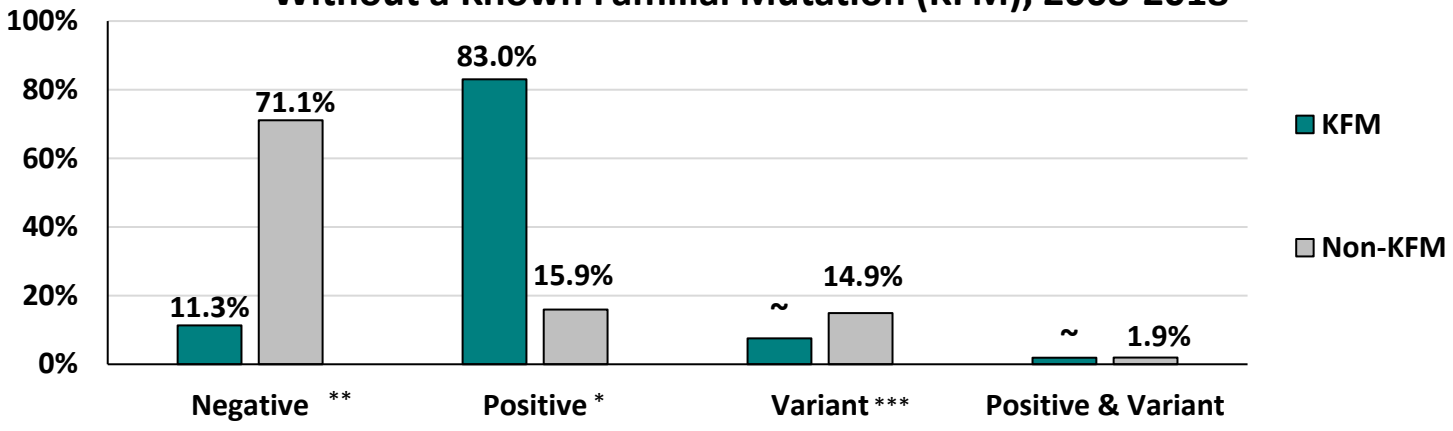


Ovarian cancer patients were more likely to have a positive result (**18.4% vs. 10.5%**), a variant of uncertain significance (**15.3% vs. 10.9%**) and a combination of both (**2.1% vs. 0.7%**) compared to those with breast cancer (data not shown).

Number of Patients who Tested Positive for Each Gene, 2008-2018

ATM = 8	*BRIP1* = 12	*BRCA1* = 51
CHEK2 = 9	*MUTYH* = 8	*BRCA2* = 40

Genetic Test Results among Ovarian Cancer Patients With and Without a Known Familial Mutation (KFM), 2008-2018

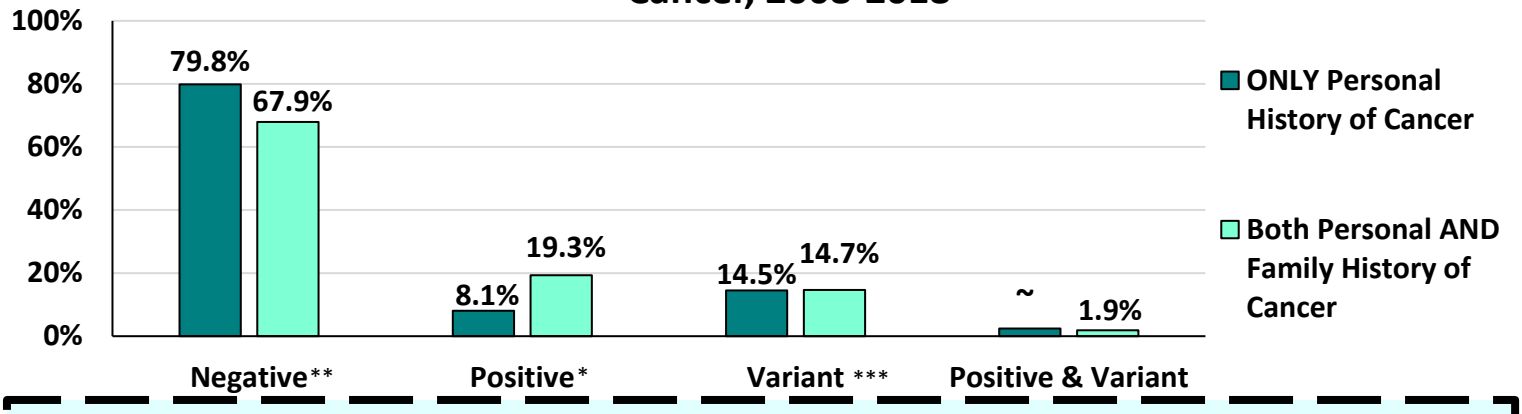


- Ovarian cancer patients with a KFM were more likely to have a positive genetic test result compared to ovarian cancer patients who did not have a KFM (**83.0% vs. 15.9%; data not shown**).

* Pathogenic/Positive result refers to a genetic test result being Pathogenic or Likely Pathogenic. ** Negative result refers to a genetic test result being Benign, Likely Benign or Not Clinically Significant.
*** Variant result refers to a result that is classified as a Variant of Uncertain Significance (VUS). ~ Data are suppressed when count is less than 6.

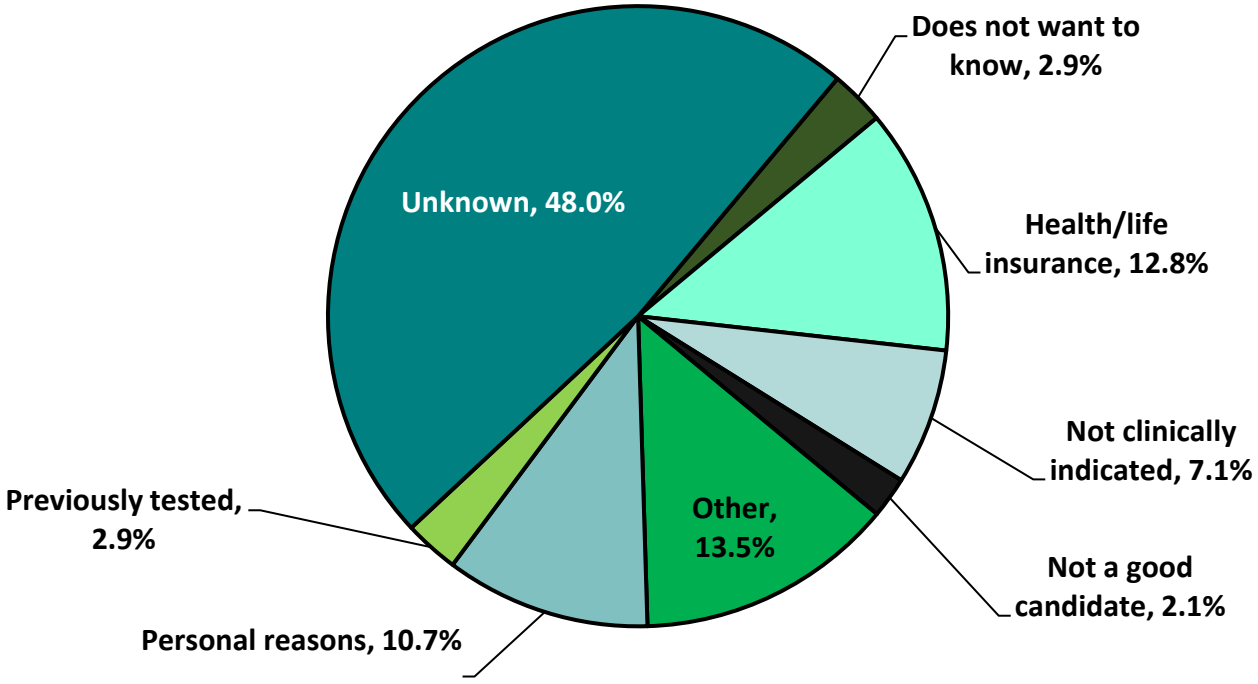
Ovarian Cancer Surveillance Status Report: Genetic Testing Continued, 2008-2018

Genetic Test Results among Ovarian Cancer Patients by History of Cancer, 2008-2018



- Ovarian cancer patients with both a personal and family history of cancer were more likely to have a positive genetic test result compared to ovarian cancer patients with only a personal history of cancer (**19.3% vs. 8.1%**).
- Those with ovarian cancer that had both a personal and family history of cancer were more likely to have the following genetic testing results compared to breast cancer patients who had both a personal and family history of cancer (data not shown).
  - Both a positive and variant test result (**1.9% vs. 0.7%**).
  - Variant of uncertain significance (**14.7% vs. 10.9%**).
  - Positive test result (**19.3% vs. 10.7%**).

Reason Why Genetic Testing Was Not Pursued Among Ovarian Cancer Patients from the HCN & BRCA Databases, 2008-2018



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Summary and Discussion

- Overall, **83.8%** of ovarian cancer patients in the HCN and BRCA databases received cancer genetic testing.
  - When looking at the ovarian cancer population in Michigan by county, we see that out of the 70 counties where ovarian cancer patients reside, **8** (**11.4%**) had genetic testing rates below 75%.
- According to NCCN and USPSTF guidelines for cancer genetic testing for breast and ovarian cancer, all patients diagnosed with ovarian cancer should receive cancer genetic services, yet only **16.2%** of these patients pursued genetic testing.
  - When looking at the reasons why testing was not pursued, **almost half** were unknown. It is important to determine what this reason is for proper intervention to get these women the services they need.
- **Approximately 58%** of ovarian cancer patients from the HCN and BRCA databases were diagnosed with more than one type of cancer.
  - **Fifteen percent** of ovarian cancer patients had also been diagnosed with breast cancer. These women have an even higher risk of being diagnosed with other types of cancer, and **37** of these patients did not pursue genetic testing.
  - **Nine percent** of ovarian cancer patients were also diagnosed with a cancer that was not breast, endometrial, prostate, colorectal or pancreatic cancer.
    - **46%** of these patients were diagnosed with this other type of cancer **under the age of 50** (data not shown). It would be important to explore which cancers these women had at a young age, which is typically diagnosed before the ovarian cancer is diagnosed. It might be important to consider genetic testing for other cancers diagnosed at a younger age than what is currently referred to cancer genetic services.
- Compared to breast cancer patients, ovarian cancer patients were more likely to have a positive result (**18.4% vs. 10.5%**), a variant of uncertain significance (**15.3% vs. 10.9%)** and a combination of both (**2.1% vs. 0.7%**).

For More Information:
Visit **Michigan.gov/HereditaryCancer** to learn more about hereditary cancers.
Visit **Michigan.gov/CGE** to view more data on hereditary cancers .

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

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MDHHS
Michigan Department of Health & Human Services

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