# A State by State Analysis of BRCA1 and BRCA2 Testing in Patients with Ovarian Cancer

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### BACKGROUND

- 11-15% of women with ovarian cancers have inherited a *BRCA1* or *BRCA2* mutation.
- As of 2008, all patients with epithelial ovarian cancer meet National Comprehensive Cancer Network (NCCN) and the Society of Gynecologic Oncology (SGO) criteria for genetic testing.
- PARP inhibitors are now available, commercially and in clinical trials, for patients with *BRCA1/BRCA2* mutations.

### **OBJECTIVES**

• The objectives of this analysis were to quantify the gap between the number of newly diagnosed patients with ovarian cancer and the *BRCA1/BRCA2* testing population nationally and by state.

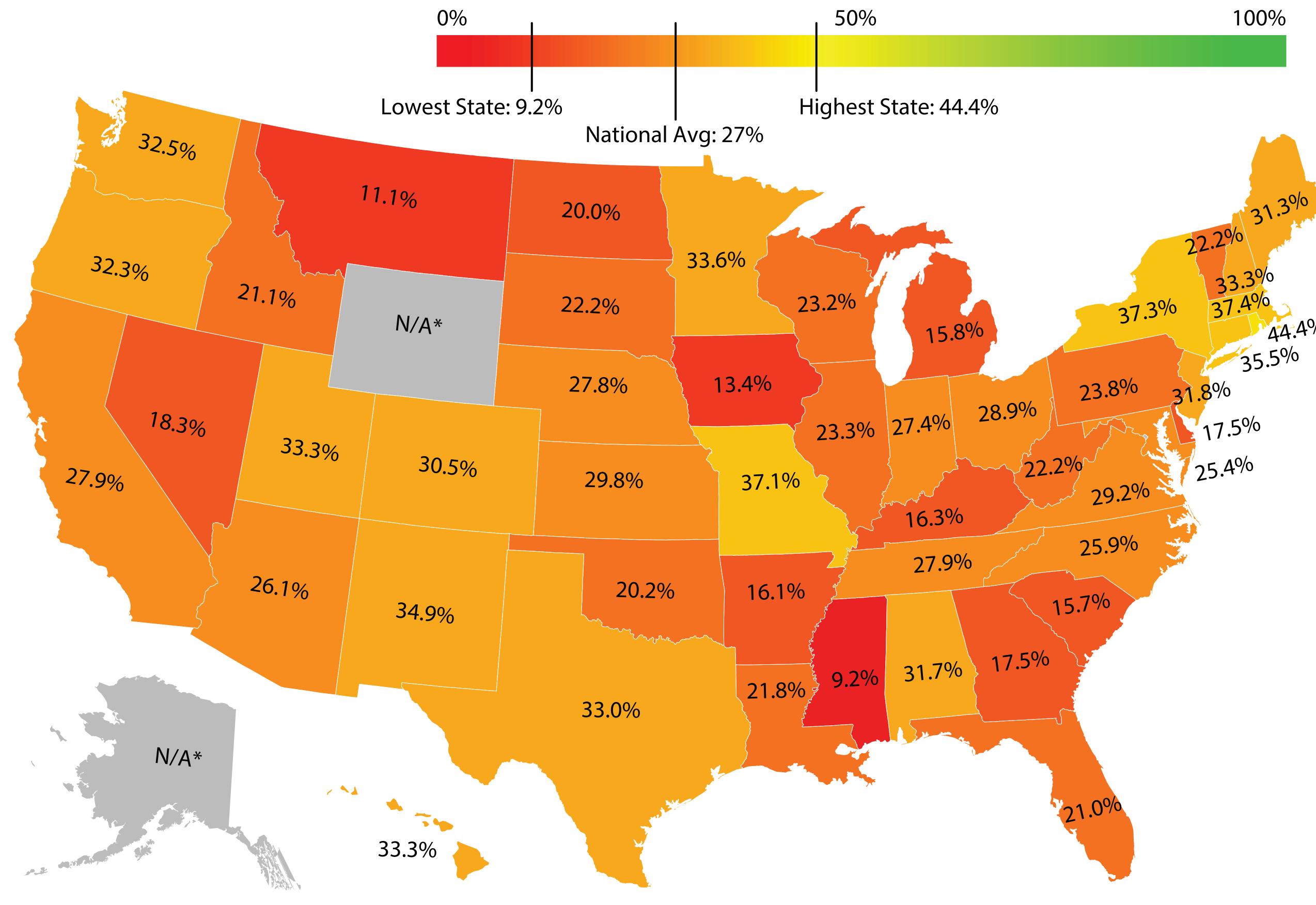
## METHODS

- We identified the number of patients diagnosed with ovarian cancer in the US annually and by state from The American Cancer Society's Annual Cancer Facts and Figures publication [1].
- These numbers were adjusted to account for the estimate that 90% of ovarian cancer diagnoses are epithelial ovarian cancer [2].
- We compared these numbers with the number of genetics tests received at a commercial lab for *BRCA1/BRCA2* testing from 2007 to 2013.
- Over this time period, this laboratory provided the majority of *BRCA1/BRCA2* testing in the US.
- Clinical information was provided by the physician on the test request form.
- Newly-diagnosed patients were defined as those tested within a year of diagnosis. Follow-up patients are those tested more than a year after their diagnosis.
- The percentages of patients tested according to age-at-diagnosis were based on SEER incidence rates [3] adjusted to the 2000 US Standard Population [4].
- The most recent state demographic, education, and healthcare data available at census.gov was explored for possible correlations with testing rates per state.
- Spearman's Rank-Order Correlation was utilized in the correlation analysis. The p-values were adjusted using the Holm method to account for multiple comparisons. Any adjusted p-value less than 0.05 was considered significant.

# • 27% of newly diagnosed patients with ovarian cancer were tested for *BRCA1/BRCA2* nationally in 2013 (Figure 1 and Figure 2).

- This is an increase from 8.4% in 2007 (Figure 1).
- The percentages of newly diagnosed patients with ovarian cancer that were tested in 2013 are shown according to the state in which they were tested in Figure 2.
  - RI had the highest testing rate at 44.4%.
  - States with the lowest testing rates were MS, MT and IA at 9.2%, 11.1% and 13.4%, respectively.
- The following variables were significantly positively correlated with testing rates per state in 2013:
  - Median income (p=0.003)
  - Level of education (Bachelor's degree, p=0.002; advanced degree, p=0.0003)
  - Physicians per 100,000 in the population (0.001)

Figure 2. % of Newly-Diagnosed Patients with Ovarian Cancer Tested in Each State in 2013



\*<50 estimated new ovarian cancer cases [1]; percentage could not be calculated

### RESULTS

Figure 1. % of Newly-Diagnosed Patients with Ovarian

Cancer Tested Appually

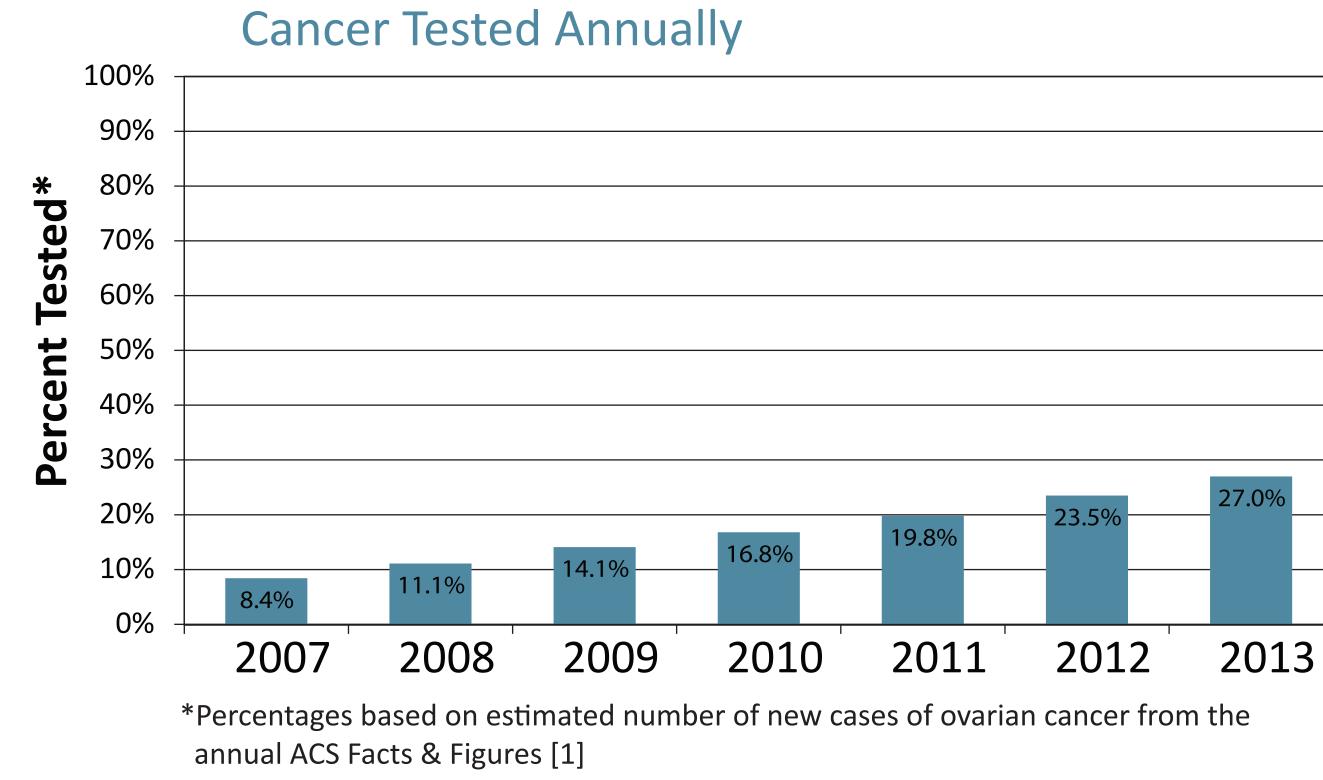


Figure 3. Proportion of Patients Tested in 2013 Found to Carry a Pathogenic Variant

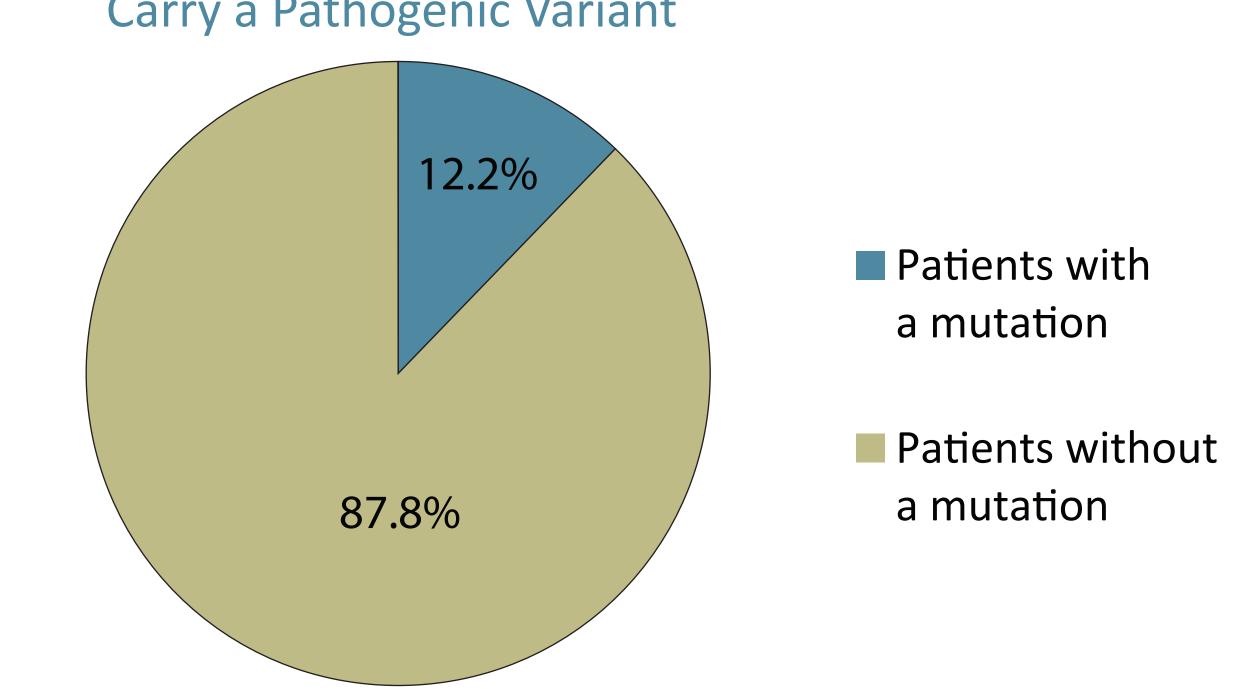


Figure 4. % of Newly-Diagnosed Patients with Ovarian

Cancer Tested Asserding to Age at Daignosis

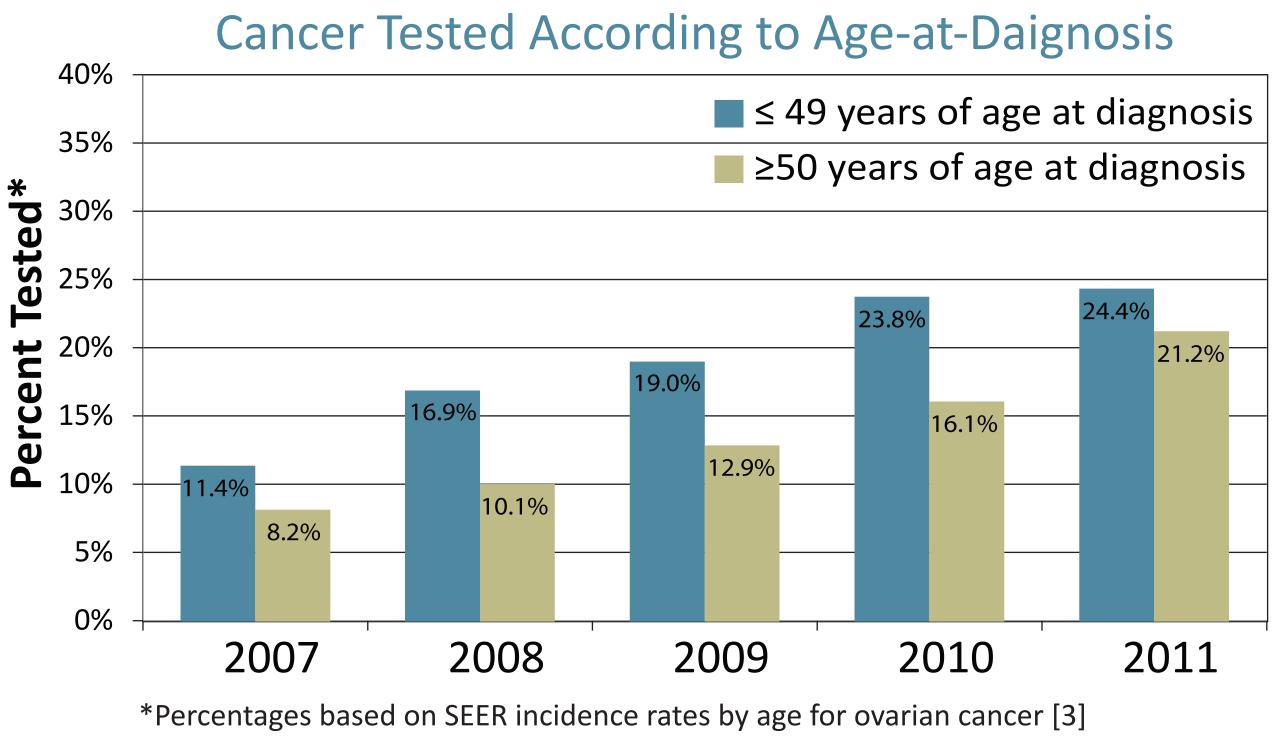
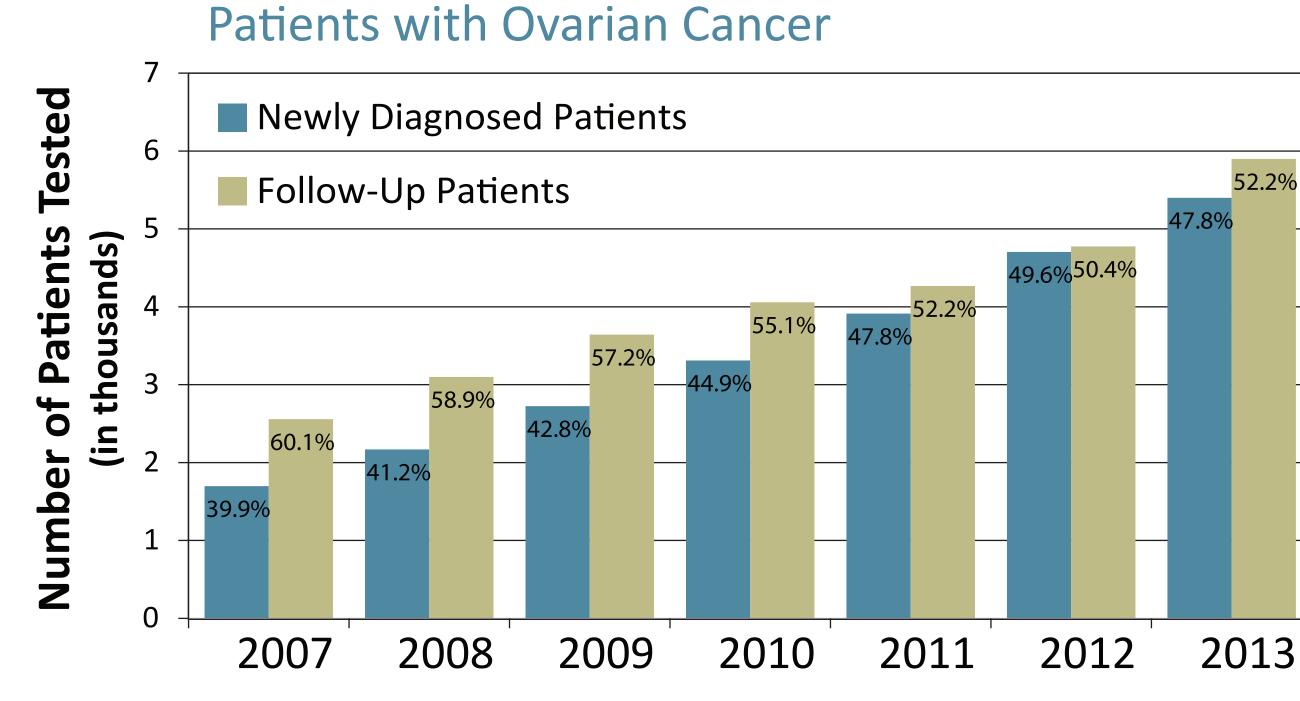


Figure 5. Testing of Newly-Diagnosed versus Follow-Up



#### CONCLUSIONS

- Although all patients with epithelial ovarian cancer have met NCCN guidelines for BRCA1/BRCA2 testing since 2008, only 27% of newly diagnosed patients were tested in 2013.
- In this analysis, there was over a three-fold difference in testing prevalence among the states. Even in states with the highest testing rates, over 50% of patients were not tested within a year of diagnosis.
- Patient and provider education as well as approval of novel agents targeting BRCA1/BRCA2 genetic mutations and the identification of additional genes associated with ovarian cancer will likely improve testing rates.

### REFERENCES

- 1. American Cancer Society. Cancer Facts & Figures; http://www.cancer.org/research/cancerfactsstatistics/allcancerfactsfigures/index.
- 2. American Cancer Society. Ovarian Cancer Detailed Guide. 2014; http://www.cancer.org/acs/groups/cid/documents/webcontent/003130-pdf.pdf
- 3. Surveillance, Epidemiology, and End Results (SEEER) Program (www. seer.cancer.gov), National Cancer Institute, Age-adjusted SEER Incidence Rates by Age-at-Diagnosis. Ovary, All Races, Female (SEER 9).
- 4. US Census Bureau Current Population Reports: Population Projections of the United States by Age, Sex, Race, and Hispanic Origin: 1995 to 2050. 1996.

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