

# Two Research Applications using the Arkansas APCD Data: Social Network Analysis of Opioid Use and Trends in Hereditary Cancer Screening

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# Characteristics and Network Influence of Providers Involved in the Treatment of Patients With Chronic Back, Neck or Joint Pain in Arkansas

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# Study Aims

- Identify characteristics of influential providers in the network of patients with newly diagnosed chronic back, neck, or joint pain
- Identify the network positions of opioid-prescribing physicians and how those varied by opioid prescribing volume
- Identify the characteristics of providers facilitating referrals from non-opioid to opioid-prescribing providers, also known as brokers
- Social Network Characteristics:
  - Indegree: **Importance** based on the number of referrals directed toward them
  - Eigen Centrality: **Importance of Neighbors** of nodes based on referrals directed towards neighbors
  - Clustering: **Importance** among triad of connected nodes
  - Betweenness: **Involvement** based ability to fall between efficient paths
  - Closeness: **Reach** based on the number of paths to connect to other nodes
  - Brokers: Nodes that facilitate **connections** between non-opioid providers and opioid providers

# Data Source and Subjects

- Arkansas APCD 2013 – 2017
- Patients
  - Newly diagnosed chronic back, neck, or joint pain residing and seeking care in Arkansas.
    - Index date: First pain episode
- Providers
  - Providers caring for identified patient that had a pain diagnosis on at least one claim for the patient
    - PCP, Specialist, Pain Specialist, Emergency Medicine, Non-pharmacologic Provider (PT)
    - Opioid and non-Opioid Providers

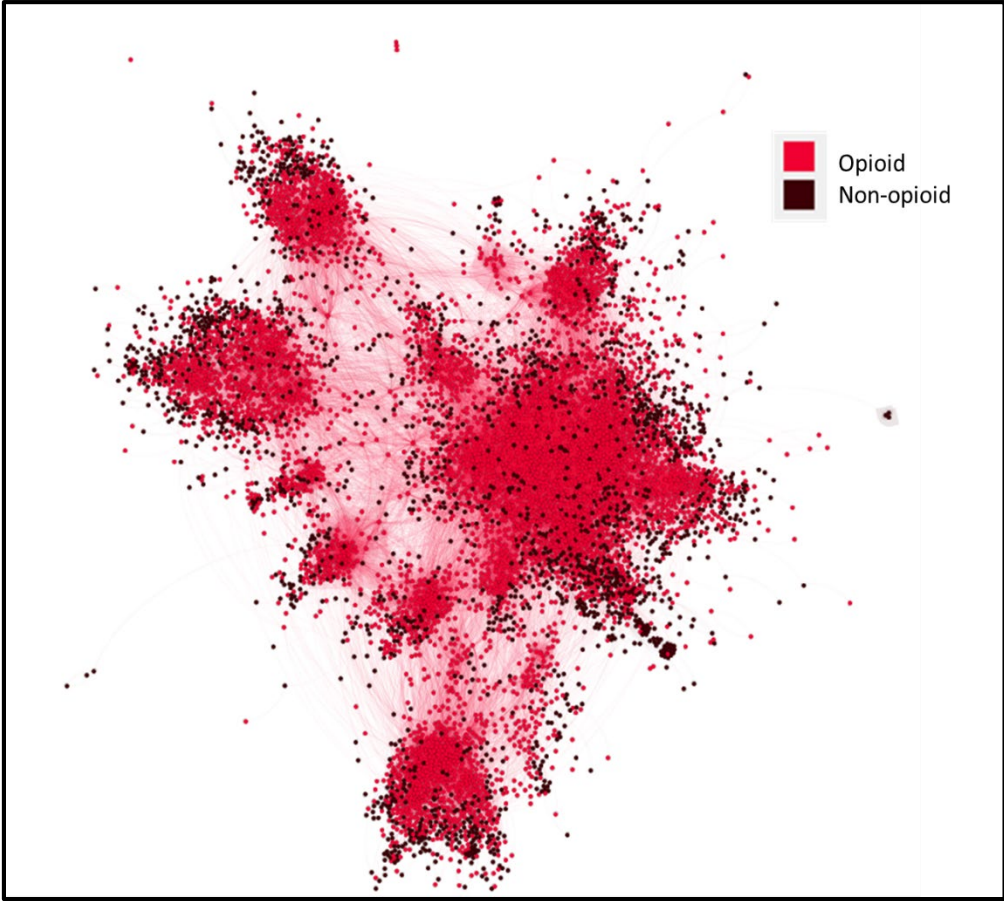
# Network Formation

- Plurality Provider: Provider with the most visits for a patient
- Referrals: Shared Connections between providers based on providers seeing common patients
  - Identified by the referring provider when available on a claim
  - Searching for subsequent claims within 90 days among each patient
- Connections between providers within networks, in this case referrals were graphically represented using GEPHI® software

- 7,123 Providers cared for 51,941 Patients with Pain
  - 54% were PCPs, 14% NPPs, 9% Pain Medicine
  - 64% prescribed opioids
  - 65% were male
  - 39% were between 35 and 49 years old
- 325,996 Referral between providers
  - PCP-PCP 28% of referrals
  - PCP-NPP 20% of referrals
  - 70% of referrals involved an opioid provider

# Network of opioid and non opioid providers

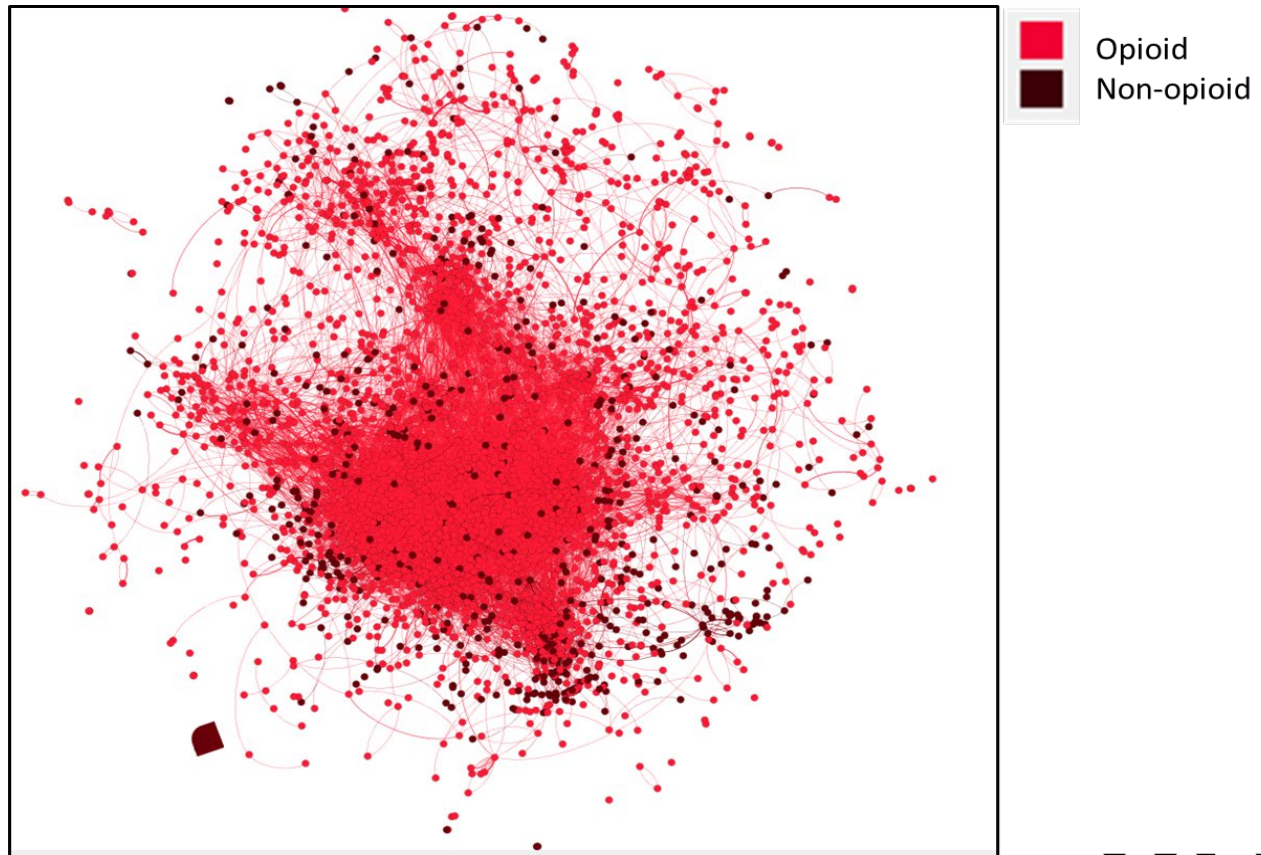
## Statewide - Arkansas



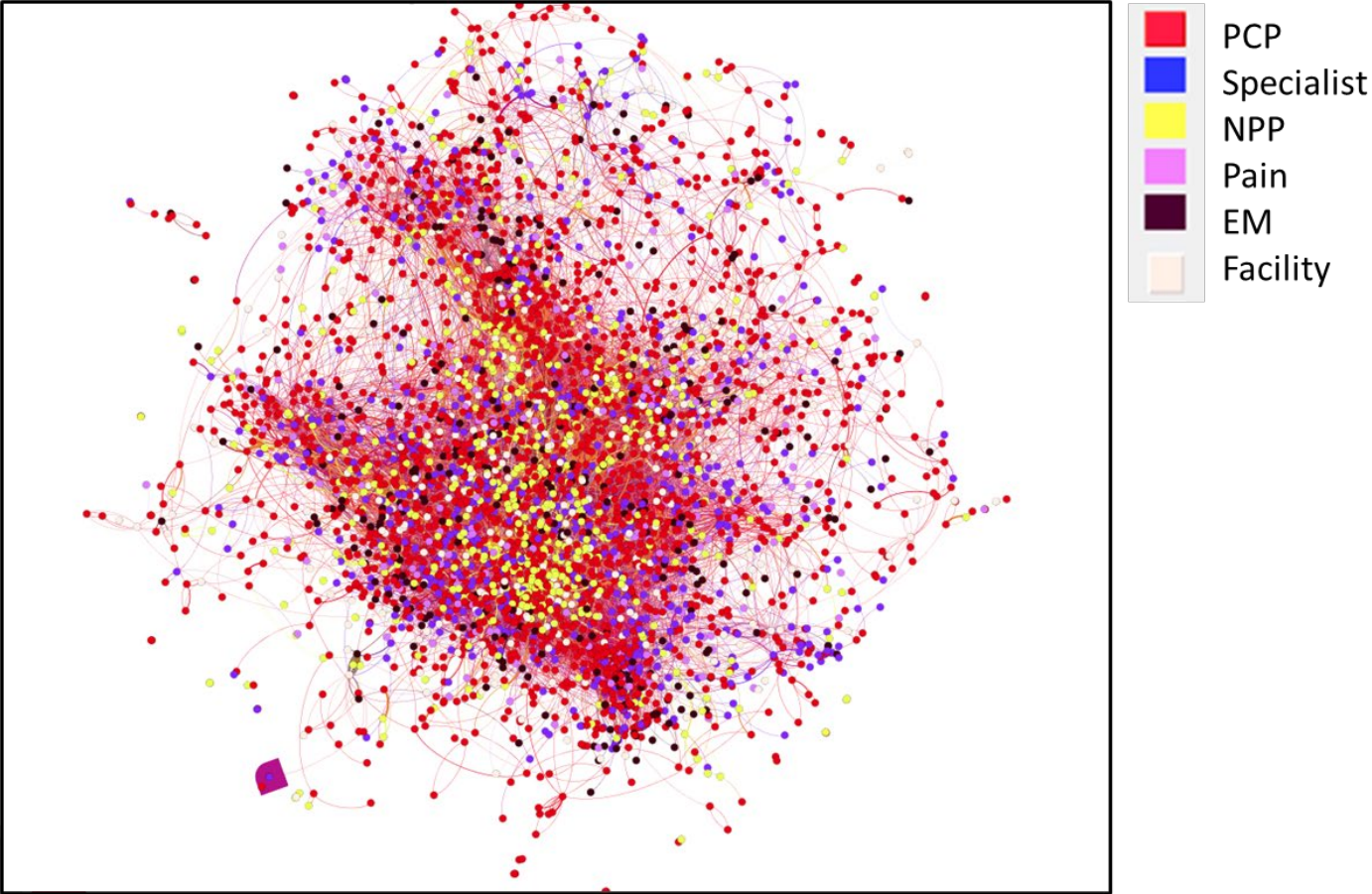


# Network of opioid and non opioid providers

## Central Region of Arkansas



# Referral networks of providers seeing patients living in central region of AR by specialty



# Key Takeaways

- Opioid Providers were MORE likely to be in central positions and have better reach than non-opioid providers
  - Opioid Providers had HIGHER:
    - indegree, eigen centrality, closeness centrality
- High Volume Opioid Providers were LESS likely to be in central positions compared to Low Volume Opioid Providers
  - High Volume Opioid Providers had LOWER:
    - betweenness, indegree and eigen centrality
- Brokers connecting opioid and non-opioid providers were more likely to be:
  - middled aged males, chiropractors / physical therapist

# Statewide trends and factors associated with genetic testing for hereditary cancer risk in Arkansas 2013–2018

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# Study Aims

- Assess the quarterly trends of genetic testing in four categories:
  - HBOC testing, Lynch syndrome testing, tier 2 molecular (general) pathology procedures, composite measure of receipt of any cancer genetic testing
    - Stratified by those with commercial, Medicaid, state employee, or Medicare coverage
- The second objective was to identify demographic, clinical, and insurance coverage factors associated with enrollees receiving the four types of genetic testing.

# Data Source and Subjects

- Arkansas APCD
  - Medicaid and Commercial: Jan 2013 – June 2018
  - State Employees: Jan 2013 – Dec 2017
  - Medicare: Jan 2013 – Dec 2016
- Aim 1 Subjects
  - Enrollees with at least one month of enrollment for both medical and pharmacy benefits in each quarter
- Aim 2 Subjects
  - Enrollees with 24 months of continuous enrollment in both medical and pharmacy benefits
  - Had to be free of cancer prior to a genetic screen
    - Most recent 24 month period used to assess covariates and genetic cancer screening

# Genetic Testing Measures

Genetic testing categories	Description	CPT-4/HCPCS codes
HBOC syndrome testing	BRCA1/2	81162, 81163, 81164, 81165, 81166, 81167, 81211, 81212, 81213, 81214, 81215, 81216, 81217
	Panel	81432, 81433, 0102U, 0103U, 0129U, 0131U, 0132U, 0133U, 0138U
Lynch syndrome testing	Individual genes	81292, 81293, 81294, 81295, 81296, 81297, 81298, 81299, 81300, 81317, 81318, 81319
	Panel	0130U, 0162U
Other HCS panel testing	Hereditary polyposis genes	81201, 81202, 81203
	Multiple endocrine neoplasia panel	81437, 81438
	Cowden syndrome/PTEN	81321, 81322, 81323
	Hereditary multicancer panel	0104U, 0134U, 0135U, 81435, 81436
Tier 2 molecular pathology procedures*		81403, 81404, 81405, 81406, 81408, 81479

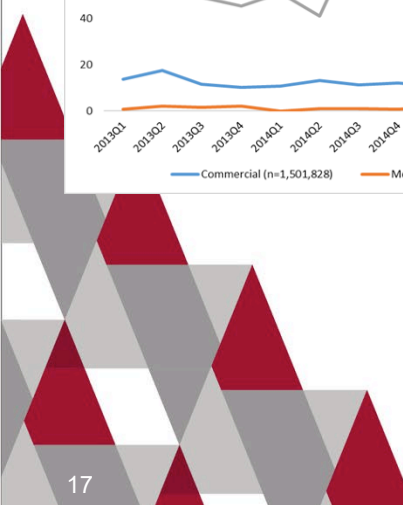
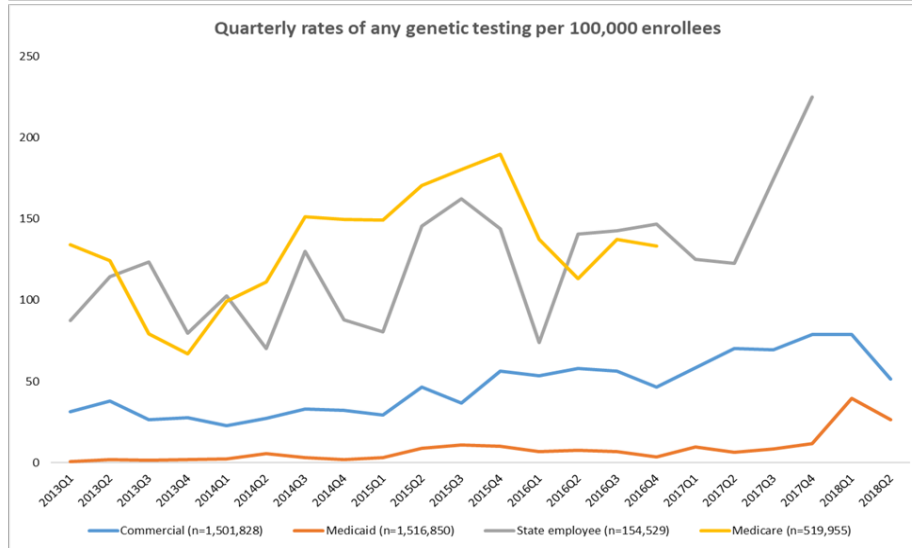
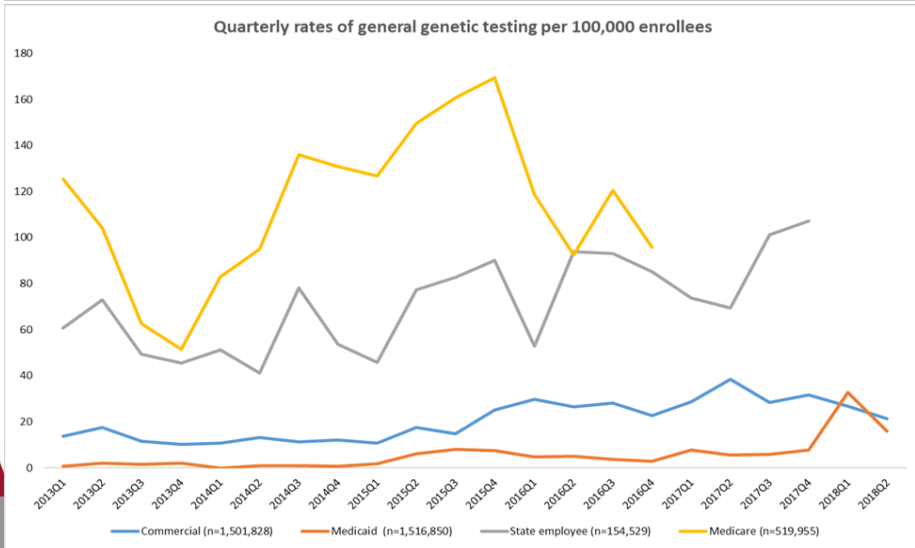
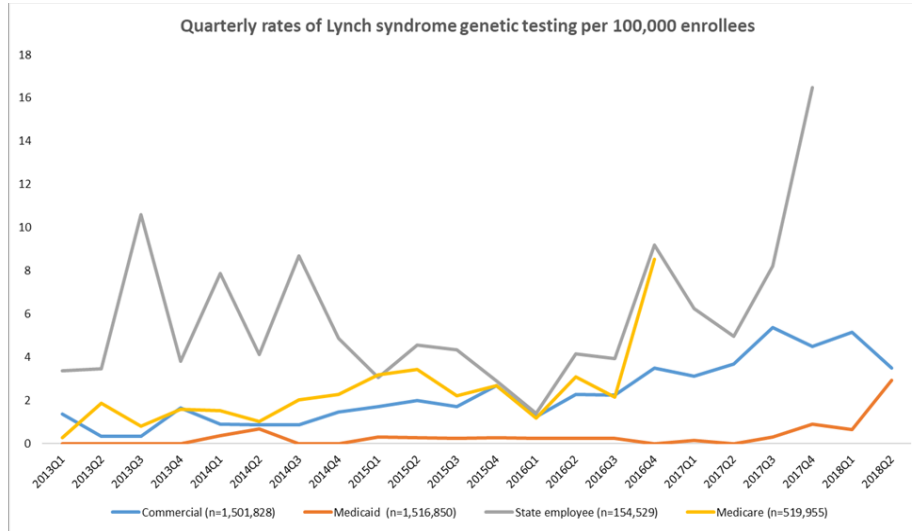
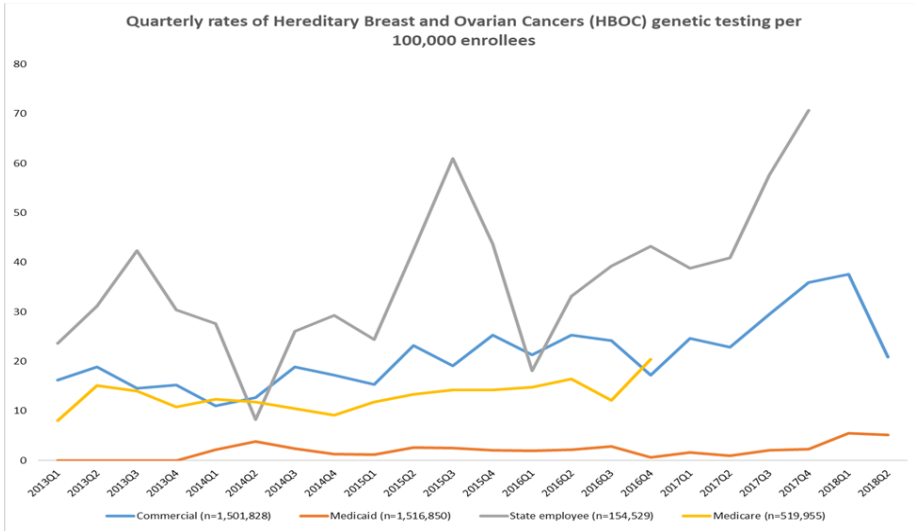
HBOC: Hereditary Breast and Ovarian Cancer  
 CPT-4: Current Procedural Terminology-4  
 HCPCS: Healthcare Common Procedure Coding System  
 HCS: hereditary cancer syndrome



# Study Measures and Analysis

- Aim 1
  - Quarterly measures of HBOC testing stratified by:
    - Plan Type, Age, Sex
  - OLS Time Series
    - Linear and Quadratic Trends
- Aim 2
  - Separate Logistic models
    - Receipt of each type of genetic test
    - Covariates:
      - Demographics, Elixhauser Comorbidity, Mental Health, Nicotine Dependence, Area or Residence





<b>Variable</b>	<b>HBOC Odds Ratio (95% CI)</b>	<b>HBOC (female-only sample) Odds Ratio (95% CI)</b>	<b>Lynch Syndrome Odds Ratio (95% CI)</b>	<b>General Genetic Testing* Odds Ratio (95% CI)</b>	<b>Any Cancer Genetic Testing** Odds Ratio (95% CI)</b>
<b>Age</b>	<b>1.24 (1.20, 1.28)</b>	<b>1.25 (1.21, 1.29)</b>	<b>1.22 (1.12, 1.36)</b>	<b>1.04 (1.03, 1.06)</b>	<b>1.06 (1.04, 1.07)</b>
<b>Age (Squared)</b>	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)
<b>Modified Elixhauser Index</b>	<b>1.08 (1.05, 1.12)</b>	<b>1.07 (1.03, 1.10)</b>	<b>1.12 (1.03, 1.20)</b>	<b>1.13 (1.12, 1.14)</b>	<b>1.13 (1.12, 1.14)</b>
<b>Sex (reference = Male) Female</b>	<b>18.91 (13.01, 28.86)</b>	-----	<b>1.93 (1.11, 3.51)</b>	<b>0.90 (0.83, 0.99)</b>	<b>1.22 (1.12, 1.32)</b>
<b>Health Plan (reference = Commercial) State employee</b>	<b>1.65 (1.37, 1.97)</b>	<b>1.64 (1.36, 1.97)</b>	<b>1.66 (0.77, 3.34)</b>	<b>4.54 (3.94, 5.23)</b>	<b>2.66 (2.35, 3.00)</b>
<b>Medicaid</b>	<b>0.24 (0.18, 0.32)</b>	<b>0.22 (0.17, 0.30)</b>	<b>0.78 (0.36, 1.58)</b>	<b>0.52 (0.43, 0.64)</b>	<b>0.33 (0.28, 0.40)</b>
<b>Medicare</b>	<b>0.41 (0.30, 0.56)</b>	<b>0.38 (0.27, 0.52)</b>	0.86 (0.41, 1.74)	<b>3.93 (3.45, 4.50)</b>	<b>2.42 (2.16, 2.71)</b>
<b>State Region (reference = Northwest) West</b>	<b>0.42 (0.31, 0.56)</b>	<b>0.43 (0.31, 0.57)</b>	<b>0.63 (0.26, 1.53)</b>	<b>0.85 (0.72, 1.01)</b>	<b>0.79 (0.68, 0.91)</b>
<b>East</b>	<b>0.70 (0.57, 0.88)</b>	<b>0.69 (0.56, 0.87)</b>	<b>0.62 (0.28, 1.39)</b>	<b>0.83 (0.71, 0.97)</b>	<b>0.83 (0.72, 0.95)</b>
<b>Central</b>	<b>0.66 (0.52, 0.84)</b>	<b>0.66 (0.52, 0.84)</b>	<b>0.37 (0.13, 0.93)</b>	1.11 (0.95, 1.29)	1.01 (0.88, 1.17)
<b>Northeast</b>	<b>0.28 (0.15, 0.36)</b>	<b>0.23 (0.14, 0.36)</b>	<b>0.30 (0.06, 1.05)</b>	<b>0.72 (0.58, 0.88)</b>	<b>0.64 (0.53, 0.77)</b>
<b>North Central</b>	<b>0.59 (0.43, 0.80)</b>	<b>0.56 (0.40, 0.77)</b>	1.47 (0.66, 3.38)	<b>0.51 (0.41, 0.63)</b>	<b>0.54 (0.45, 0.65)</b>
<b>Midwest</b>	<b>0.42 (0.30, 0.57)</b>	<b>0.41 (0.30, 0.57)</b>	0.69 (0.26, 1.76)	<b>1.20 (1.02, 1.42)</b>	1.07 (0.92, 1.27)
<b>Any Nicotine Usage (reference = No)</b>	0.88 (0.70, 1.11)	0.90 (0.71, 1.13)	1.05 (0.54, 1.95)	1.07 (0.95, 1.20)	1.01 (0.90, 1.12)
<b>Developmental Disorders (reference = No)</b>	0.85 (0.28, 1.92)	0.97 (0.32, 2.20)	0.43 (0.00, 3.09)	1.11 (0.84, 1.44)	1.12 (0.86, 1.44)
<b>Anxiety Disorders (referent = No)</b>	1.19 (0.99, 1.43)	<b>1.22 (1.01, 1.47)</b>	1.37 (0.75, 2.45)	<b>1.61 (1.45, 1.78)</b>	<b>1.54 (1.40, 1.67)</b>
<b>Other Mental Disorders (reference = No)</b>	<b>1.53 (1.15, 2.00)</b>	<b>1.56 (1.17, 2.05)</b>	<b>4.36 (2.28, 7.98)</b>	<b>1.60 (1.39, 1.83)</b>	<b>1.59 (1.40, 1.80)</b>
<b>Model c-statistic</b>	0.88	0.81	0.82	0.82	0.79

# Takeaways

- Modest increase in genetic testing for HBOC and Lynch syndrome across Medicaid, commercial, state employee and Medicare
  - Rates in AR were still lower than observed in other states
- Gender, Residence, and Plan Type are key determinants in accessing genetic screening
  - Substantially lower Genetic Screening rates in Medicaid suggest providers may not offer these screens to minorities or to those with less education

# Questions and Suggestions

