Factors Associated with Cancer Prevention Surgeries for Hereditary Cancer Risk in Arkansas 2013-2018

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BACKGROUND

- Identification of individuals with hereditary cancer syndromes (HCS) provides opportunities for managing cancer risk through screening to allow for early diagnosis and prevention strategies to avoid development of cancer altogether.
- The aim of this study was to describe the use of cancer preventive strategies (mastectomy and salpingo-oophorectomy) among women with documented hereditary susceptibility to breast or ovarian cancer and to describe the demographic, geographic, clinical, and health system factors associated with the use of these cancer prevention strategies.

METHODS

- **Study design:** Retrospective cohort study.
- **Data source:** Claims records from January 2013 through June 2018 (commercial, state employee and Medicaid) or December 2016 (Medicare) from Arkansas All-Payer Claims Database (APCD) were used.
- **Study Subjects:** Patients with genetic susceptibility to breast or ovarian cancer were identified using ICD-9-CM (V84.01, V84.02, V84.03, V84.09) or ICD-10-CM (Z15.01, Z15.02. Z15.03, Z15.09) codes.
  - The date of the first claim with a diagnosis of genetic susceptibility to cancer was designated as the index date.
  - Patients with ≥180 days of continuous eligibility for both pharmacy and medical benefits before the index date and at least one day after the index date were included.
  - Patients were followed until preventive surgery, study end date or loss of enrollment.
- **Cancer Preventive Measures:** Mastectomy and salpingo-oophorectomy documented by CPT-4 codes.
- **Covariates:** Demographics, Index Year and State Geographic factors were assessed at the index date and Clinical factors (comorbidities, prior cancer, mental disorders, nicotine dependence) were assessed in the 6-month pre-index period
- **Study cohorts:** Breast cancer naïve cohort (no breast cancer diagnosis before index date) and ovarian cancer naïve cohort (no ovarian cancer diagnosis before index date).
- **Statistical analysis:** Multivariable Cox proportional hazard regression models for time to mastectomy and salpingo-oophorectomy were estimated.

RESULTS

- There were 836 individuals with HCS in the breast cancer naïve cohort and 266 in the ovarian cancer naïve cohort.
- Among breast cancer naïve enrollees with HCS, 153 (18.30%) underwent either a mastectomy or salpingo-oophorectomy: 97 (11.60%) underwent mastectomy and 80 (9.57%) underwent salpingo-oophorectomy. Age was the only factor inversely associated with salpingo-oophorectomy (HR=0.81; 95% CI:0.67-0.97), while Medicare coverage (HR=0.23; 95% CI:0.09-0.61) and state geographical region were associated with mastectomy.
- Among ovarian cancer naïve enrollees with HCS, 141 (53.01%) underwent either a mastectomy or salpingo-oophorectomy: 42 (15.79%) underwent mastectomy and 99 (37.22%) underwent salpingo-oophorectomy. Age was the only factor inversely associated with mastectomy (HR=0.66; 95% CI:0.49-0.90), while prior breast cancer diagnosis (HR=2.22; 95% CI:1.40-3.53) and year of genetic susceptibility to ovarian cancer diagnosis were associated with salpingo-oophorectomy.

Table 1: Demographic, Clinical and Health Plan Characteristics of the Study Samples

Characteristic	Breast cancer naïve cohort N=836	Ovarian cancer naïve cohort N=266
Age (years) at cancer susceptibility Mean (SD)	48.53 (15.25)	47.23 (13.35)
Elixhauser Comorbidity Index Mean (SD)	1.23 (1.70)	1.63 (1.82)
Gender		
Female	814 (97.37%)	266 (100.00%)
Male	22 (2.63%)	0 (0.00%)
Health Plan		
Medicare	139 (16.63%)	31 (11.65%)
Non-Medicare	697 (83.37%)	235 (88.35%)
Anxiety Disorders		
Yes	128 (15.31%)	57 (21.43%)
No	708 (84.69%)	209 (78.57%)
Other Mental Disorders		
Yes	19 (2.27%)	11 (4.14%)
No	817 (97.73%)	255 (95.86%)
Nicotine Dependence		
Yes	54 (6.46%)	19 (7.14%)
No	782 (93.54%)	247 (92.86%)
Year of cancer susceptibility diagnosis		
2013	24 (14.95%)	1217 (9.02%)
2014	38 (22.13%)	976 (14.29%)
2015	42 (16.63%)	696 (15.79%)
2016	58 (14.47%)	612 (21.80%)
2017	84 (19.74%)	565 (31.58%)
2018	20 (12.08%)	281 (7.52%)
State Region [a]		
Central	75 (8.97%)	52 (19.55%)
East	97 (11.60%)	60 (22.56%)
North Central	77 (9.21%)	16 (6.02%)
Northeast	38 (4.55%)	20 (7.52%)
West	48 (5.74%)	31 (11.65%)
Midwest	90 (10.77%)	35 (13.16%)
Northwest	411 (49.16%)	52 (13.16%)

Notes: [a] State Region (three-digit zip code): Central (721, 722), East (716, 720, 723), North Central (725, 726), Northeast (724), West (717, 718, 719), Midwest (728, 729), Northwest (727).

Table 2: Cox Proportional Hazard Model Results of Time to Mastectomy

Characteristic	Hazard Ratio (95% CI) Breast cancer naïve cohort Event (n=97)	Hazard Ratio (95% CI) Ovarian cancer naïve cohort Event (n=42)
Age/10 (years) at cancer susceptibility	0.89 (0.76, 1.06)	0.66 (0.49, 0.90)
Elixhauser Comorbidity Index	1.02 (0.88, 1.17)	0.94 (0.73, 1.20)
Health Plan (ref. = non-Medicare)		
Medicare	0.23 (0.09, 0.61)	0.40 (0.08, 1.92)
Anxiety Disorders (ref. = No)		
Yes	1.05 (0.60, 1.86)	0.71 (0.30, 1.69)
Other Mental Disorders (ref. = No)		
Yes	0.98 (0.29, 3.26)	2.43 (0.61, 9.68)
Nicotine Dependence (ref. = No)		
Yes	0.54 (0.20, 1.45)	2.15 (0.69, 6.72)
Baseline Breast Cancer Diagnosed (ref. = No)		
Yes	-	1.02 (0.45, 2.32)
Baseline Ovarian Cancer Diagnosed (ref. = No)		
Yes	1.77 (0.72, 4.34)	-
Year of cancer susceptibility diagnosis (ref.=2013)		
2014	1.58 (0.74, 3.38)	1.37 (0.43, 4.42)
2015	1.99 (0.91, 4.31)	0.92 (0.29, 2.93)
2016	2.74 (1.25, 6.01)	0.70 (0.21, 2.30)
2017	1.47 (0.66, 3.30)	0.41 (0.12, 1.38)
2018	0.78 (0.21, 2.89)	0.29 (0.03, 2.68)
State Region [a] (ref. = Northwest)		
Central	2.33 (1.21, 4.47)	0.70 (0.23, 2.17)
East	2.18 (1.18, 4.04)	0.98 (0.35, 2.72)
North Central	1.52 (0.69, 3.38)	2.02 (0.57, 7.13)
Northeast	0.80 (0.24, 2.64)	0.58 (0.14, 2.39)
West	5.13 (2.65, 9.91)	1.92 (0.59, 6.26)
Midwest	1.38 (0.66, 2.89)	1.57 (0.57, 4.34)

Notes: ref.: Reference category for the variable. CI: Confidence intervals.
[a] State Region (three-digit zip code): Central (721, 722), East (716, 720, 723), North Central (725, 726), Northeast (724), West (717, 718, 719), Midwest (728, 729), Northwest (727).

Table 3: Cox Proportional Hazard Model Results of Time to Salpingo-Oophorectomy

Characteristic	Hazard Ratio (95% CI) Breast cancer naïve cohort Event (n=80)	Hazard Ratio (95% CI) Ovarian cancer naïve cohort Event (n=99)
Age/10 (years) at cancer susceptibility	0.81 (0.67, 0.97)	0.98 (0.82, 1.19)
Elixhauser Comorbidity Index	0.82 (0.66, 1.00)	0.91 (0.79, 1.06)
Health Plan (ref. = non-Medicare)		
Medicare	1.40 (0.60, 3.25)	0.98 (0.49, 1.95)
Anxiety Disorders (ref. = No)		
Yes	1.58 (0.84, 2.96)	1.21 (0.72, 2.03)
Other Mental Disorders (ref. = No)		
Yes	0.46 (0.06, 3.43)	0.92 (0.32, 2.64)
Nicotine Dependence (ref. = No)		
Yes	0.15 (0.02, 1.09)	1.23 (0.52, 2.88)
Baseline Breast Cancer Diagnosed (ref. = No)		
Yes	-	2.22 (1.40, 3.53)
Year of cancer susceptibility diagnosis (ref. = 2013)		
2014	1.54 (0.70, 3.41)	0.60 (0.30, 1.22)
2015	1.54 (0.66, 3.60)	0.43 (0.21, 0.91)
2016	1.70 (0.70, 4.13)	0.45 (0.22, 0.92)
2017	1.73 (0.73, 4.12)	0.30 (0.15, 0.62)
2018	1.29 (0.39, 4.33)	0.31 (0.10, 0.96)
State Region [a] (ref. = Northwest)		
Central	2.05 (1.00, 4.19)	0.86 (0.45, 1.64)
East	1.46 (0.67, 3.20)	0.43 (0.22, 0.85)
North Central	2.07 (0.96, 4.47)	1.33 (0.60, 2.95)
Northeast	1.58 (0.60, 4.20)	0.38 (0.14, 1.03)
West	2.58 (1.11, 6.00)	0.92 (0.44, 1.92)
Midwest	2.02 (0.98, 4.16)	0.85 (0.43, 1.69)

Notes: ref.: Reference category for the variable. CI: Confidence intervals.
[a] State Region (three-digit zip code): Central (721, 722), East (716, 720, 723), North Central (725, 726), Northeast (724), West (717, 718, 719), Midwest (728, 729), Northwest (727).

CONCLUSIONS

- ❖ Among Arkansans with hereditary risk for breast cancer but no breast cancer diagnosis, approximately 12% underwent mastectomy and 10% underwent salpingo-oophorectomy, while among those with hereditary risk for ovarian cancer but no ovarian cancer diagnosis, about 16% underwent mastectomy and 37% underwent salpingo-oophorectomy.
- ❖ Younger women were more likely to undergo salpingo-oophorectomy or mastectomy, while those with a prior breast cancer were more likely to undergo salpingo-oophorectomy.
- ❖ Location within the state appears to have influenced undergoing these surgical cancer preventive measures.