Risk Assessment Model for Breast Cancer in Women Using MERIT Cohort Study

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Introduction

- Breast cancer is the most common cancer among women
- Mammography is the preferred standard-of-care for early detection of breast cancer.
- The MERIT cohort study is intended to improve breast cancer detection for women.
- Participants receive annual screening.
- Eligibility criteria includes being between ages 25-81 and having not had breast cancer.
- The study incorporates a questionnaire to the participants for additional data collection.

Methods

- MERIT cohort study – 6298 women taking part from 2017.
- Diagnostic screening is a regular part of the participants' routine.
- Additional risk factors gathered include breast density, BMI, menopause status, and race/ethnicity.
- 101 cases noted through early detection used for the analysis.
- BCRAT tool applied using SAS to build Gail Model.
- Relative risk of breast cancer by risk factors analyzed using BCRAT (Breast Cancer Risk Assessment Tool).
- MCRM - an improvement over Gail model built using additional factors.
- Poisson GLM applied.

Results:

- The Gail Model showed significant risk factors. Using relative risks, the number of relatives ≥ 2 was significant (RR: (1.0006, 1.0031), 95% CI (1.0005, 1.00031).
- MCRM model demonstrates better results with additional risk factors like breast density, BMI, and menstrual status.
- The interaction between breast density and age category is significant for women less than 50 (RR: 1.0052, 1.0066).
- Women above the age of 50 have a higher incidence of both dense breast tissue
- Women the ages of 25-28 have the highest occurrence of three or more relatives.
- Having two or more biopsies increases the risk of breast cancer.
- Logistic regression model implies that the relationships: number of biopsies and breast cancer risk, number of first-degree relatives and breast cancer could be causal.

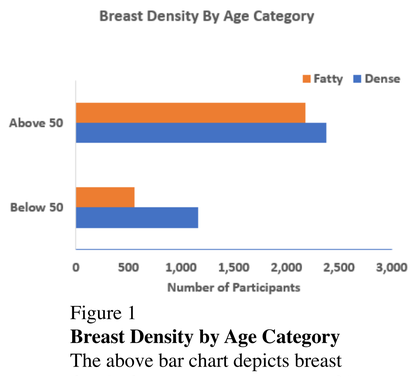

Figure 1
Breast Density by Age Category
The above bar chart depicts breast density by age category, separated into the two different age groups (Above 50 and Below 50). The incidence of both dense and fatty breasts is more prevalent in the above 50 age category.

Table of BRSTDEN by AGECAT			
	AGECAT(AGECAT)		
BRSTDEN(BRSTDEN)	0	1	Total
1	554 20.28	2178 79.72	2732
2	8 42.11	11 57.89	19
Total	562	2189	2751

Figure 2
Breast Density and Age Category
Above is a contingency table which depicts the relationship between breast density category and age category. The number 1 in the breast density category represents dense breasts and 2 represents fatty breasts. Likewise, the categories for age are noted as 0 being less than 50 years of age and 1 being greater than 50 years of age.

Statistic	DF	Value	Prob
Chi-Square	1	5.5301	0.0187
Likelihood Ratio Chi-Square	1	4.6133	0.0317
Continuity Adj. Chi-Square	1	4.2689	0.0388
Mantel-Haenszel Chi-Square	1	5.5281	0.0187
Phi Coefficient		-0.0448	
Contingency Coefficient		0.0448	
Cramer's V		-0.0448	

Figure 3
Chi-Square Tests for Association
The Mantel-Haenszel Chi-Square probability is significant implying that since the null hypothesis is rejected, there is a linear relationship between breast density and age. The other Chi-Square tests also have significant values.

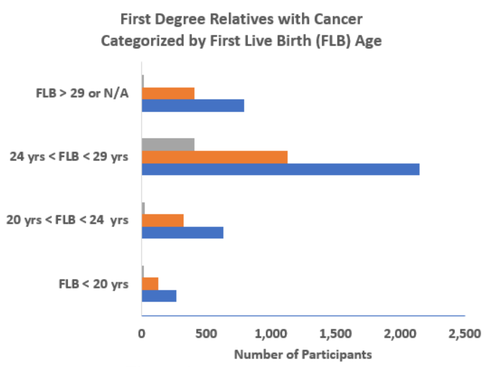

Figure 4
First Degree Relatives with Cancer by First Live Birth
The interaction between first degree relatives with cancer and age at first live birth is shown here. The age group of first live birth age that presents the highest number of relatives in each group is the 24 yrs < FLB < 29 yrs group. This age group also has the highest number of participants who have more than 2 relatives.

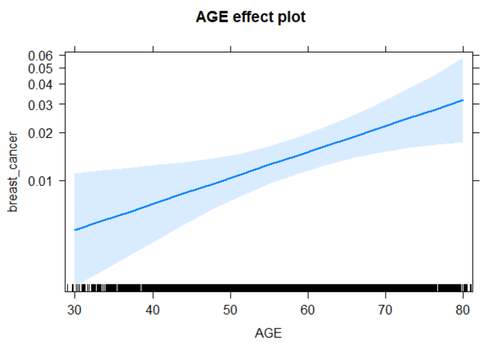

Figure 5
Age and Breast Cancer Risk
As age increases, the probability of breast cancer also increases.

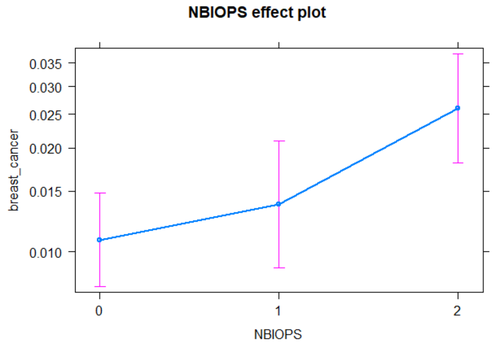

Figure 6
Number of Biopsies and Breast Cancer Risk
The probability of breast cancer increases at a faster rate after 1 biopsy has been done on the participant. The difference in probability between having 2 biopsies and 1 biopsy is 0.12.

Factors	OR	95% Confidence interval	
Intercept	0.0018	0.0005	0.0059
Age at Diagnosis	1.0320	1.0120	1.0528
#Biopsies = 1	1.2566	0.7402	2.0822
#Biopsies > 1	2.3045	1.4292	3.6904
#First Relatives = 1	1.6921	1.1251	2.5417
#First Relatives > 1	0.6508	0.2423	1.4706
Breast Density = Fatty	0.6868	0.4474	1.0374

Figure 7
Individualized Approach – Logistic Regression
The best model includes age at diagnosis, number of biopsies separated into two categories, number of first relatives also separated into two categories, and breast density (only the fatty category). The odds ratios for both # Biopsies >1 and # First Relatives = 1 are the highest amongst all the odds ratios and have larger confidence intervals in comparison to other categories.

Conclusions:

- MCRM is the first model that is based entirely on data specific to the MERIT cohort.
- The MCRM model uses additional risk factors not included in the Gail Model.
- This model needs further investigation and improvements.

Next Steps:

- The MCRM model uses additional risk factors not included in the Gail Model.
- Validation of current logistic regression model to produce a more advanced model to exceed results at present.
- This model needs further investigation and improvements.

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