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Early Prediction of Breast Cancer by Genetic Screening Profile among Young Females in Najran area (Southern Saudi Arabia) 2022-/2024

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Abstract

Breast cancers constitutes a significant health problem globally, and the pursuit of powerful early detection techniques remains paramount. This study investigates the potential for early prediction of breast cancer among younger females inside the Najran place of Southern Saudi Arabia through the use of genetic screening profiles. The study aims to elucidate genetic markers related to breast cancer susceptibility in this precise demographic, imparting insights into the disorder's early detection and potential preventive measures. A complete literature assessment establishes the modern-day know-how of breast cancer etiology, genetic factors, and screening techniques, highlighting gaps in know-how concerning the genetic profile of young females in Najran. Methodologically, a cohort of younger females will go through genetic screening protocols, coupled with designated clinical checks, enabling the identity and analysis of genetic markers related to breast cancer predisposition. Statistical evaluation may be hired to correlate recognized genetic variants with the threat of growing breast cancer, bearing in mind the construction of predictive fashions. Findings from this research keep massive promise in advancing personalized medicinal drugs and informing focused screening packages, thereby contributing to the early detection and prevention techniques precise to the young girl population within the Najran place of Southern Saudi Arabia.

Keywords: Breast cancer, genetic screening, young females, Najran, Saudi Arabia, early prediction.

INTRODUCTION

Since breast cancer is one of the most commonplace and alarming cancers in the world, it poses a danger to public fitness. Even while survival rates have elevated because of advances in prognosis and remedy, greater efficient early detection techniques are nevertheless desperately wished for. In this observation, young females in the Najran place of southern Saudi Arabia will have their breast cancer hazard factors investigated. Given the excellent genetic, environmental, and behavioral elements that can affect someone's vulnerability to this sickness, it is miles vital that this demographic obtain unique attention. This study intends to reveal new insights that would improve the early detection paradigm and potentially transform preventative remedies by analyzing the genetic screening profiles of young females (Abdel Hadi, 2000).

Najran, positioned in the southern location of Saudi Arabia, gives a unique background for this study because of its precise cultural customs, demographics, and health dynamics. The population of this area offers an attractive possibility to analyze genetic predispositions associated with breast cancer, in particular in regards to the younger lady cohort. Knowing these human beings' genetic composition and the mutations that might be commonplace among them can help discover biomarkers or genetic signatures that can point to a higher chance of growing breast cancer. Furthermore, as there is research that specializes in this location, mainly among younger women, this research objective is to fill the vacuum inside the frame of existing literature. The complex aggregate of cultural quirks, lifestyle selections, and genetic variants in Najran emphasizes how crucial it is to customize early caution systems for this unique population (Al-Thubaity *et al.*, 2023).

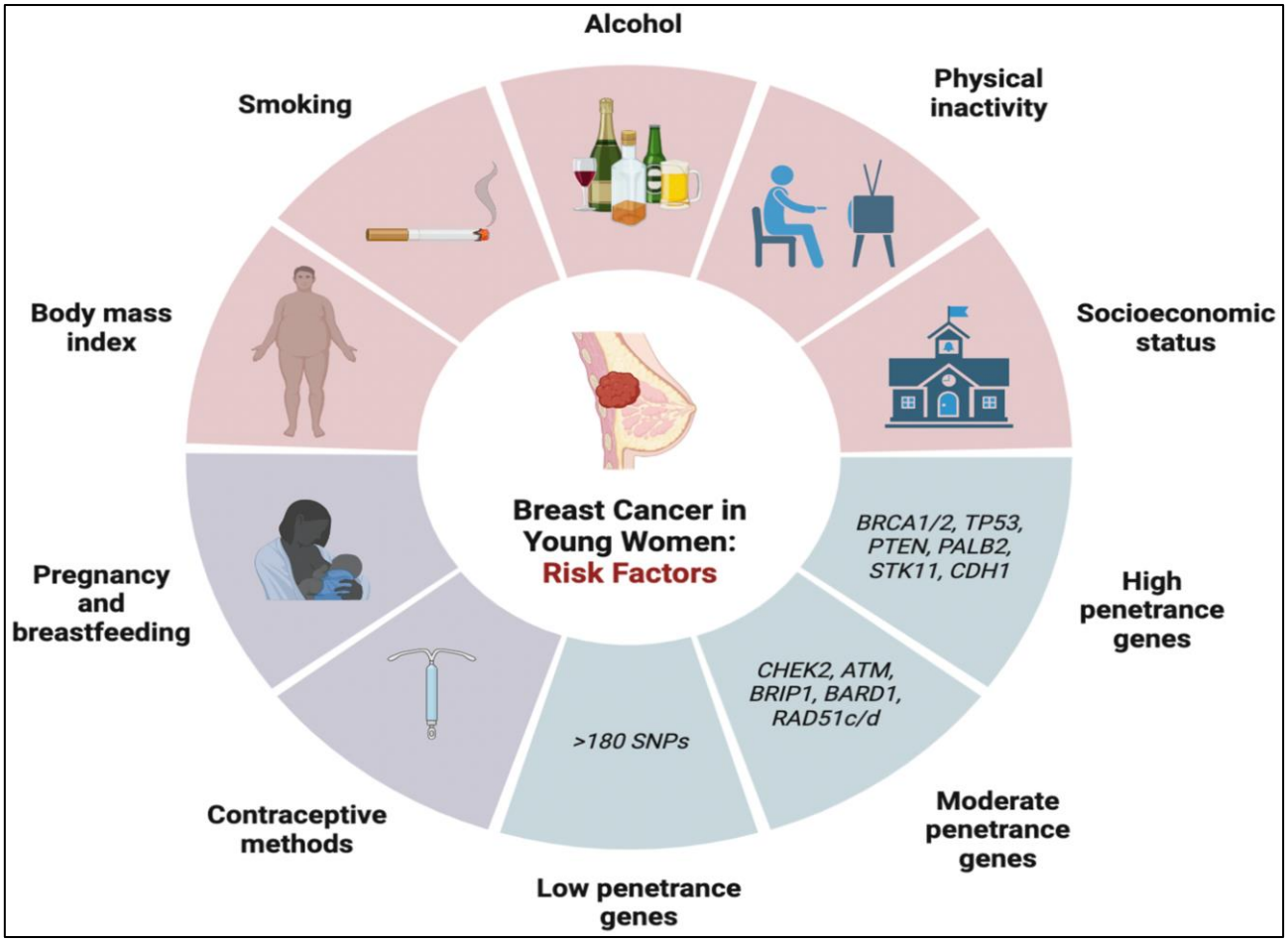

Fig. 1: Risk factors of Breast cancer in Women
[**Source:** Jie Wei Zhu *et al.*, (2023)]

A paradigm trade in healthcare has been introduced by improving novel genetic screening tools and increasing expertise on genetics' role in sickness susceptibility. As a result, there is a developing hobby of using those trends to customize remedies, mainly regarding breast cancer. Through analyzing the genetic screening profiles of young girls in Najran, this study hopes to provide important information to the sphere of breast cancer research as it develops. The expertise received from this study is expected to enhance our knowledge of the pathophysiology of breast cancer and open the door for the advent of focused, proactive strategies for early detection and intervention that may reduce the disease's effect on this unique population (Alghamdi, 2023).

Background Information

One of the most commonplace and devastating ailments impacting women internationally is breast cancer. Its prevalence has been growing over the last long time, which calls for intensive research into its complicated starting place, hazard elements, and diagnostic tactics. As the most well-known form of cancer in girls, breast cancer poses a considerable fitness threat in Saudi Arabia (Alshabeeb *et al.*, 2022). The occurrence of breast cancer has been on the rise inside the Kingdom, which has forced healthcare systems to alter and improve early detection and intervention measures. The Southern Saudi metropolis of Najran is representative of this United States of America-extensive trend, with younger girls experiencing a marked rise in the incidence of breast cancer. This indicates the urgent need to inspect the factors causing this demographic change (Aqlan *et al.*, 2023).

Although there are numerous contributing factors to breast cancer, genetics is a crucial thing in the disease's pathophysiology. The complicated interactions between genetic vulnerability and environmental factors are highlighted by using the wide variety of genetic mutations and variations that have been determined. Determining a person's danger profile and developing custom-designed treatment interventions and screening applications are made possible by having radical information on those genetic variables. Nonetheless, there is not much research explaining the genetic makeup of breast cancer in Saudi Arabia, especially in regions like Najran. As such, there may be a sizeable information vacuum regarding the particular genetic markers related to breast cancer susceptibility in younger women in this vicinity (Caswell & Kenkre, 2021).

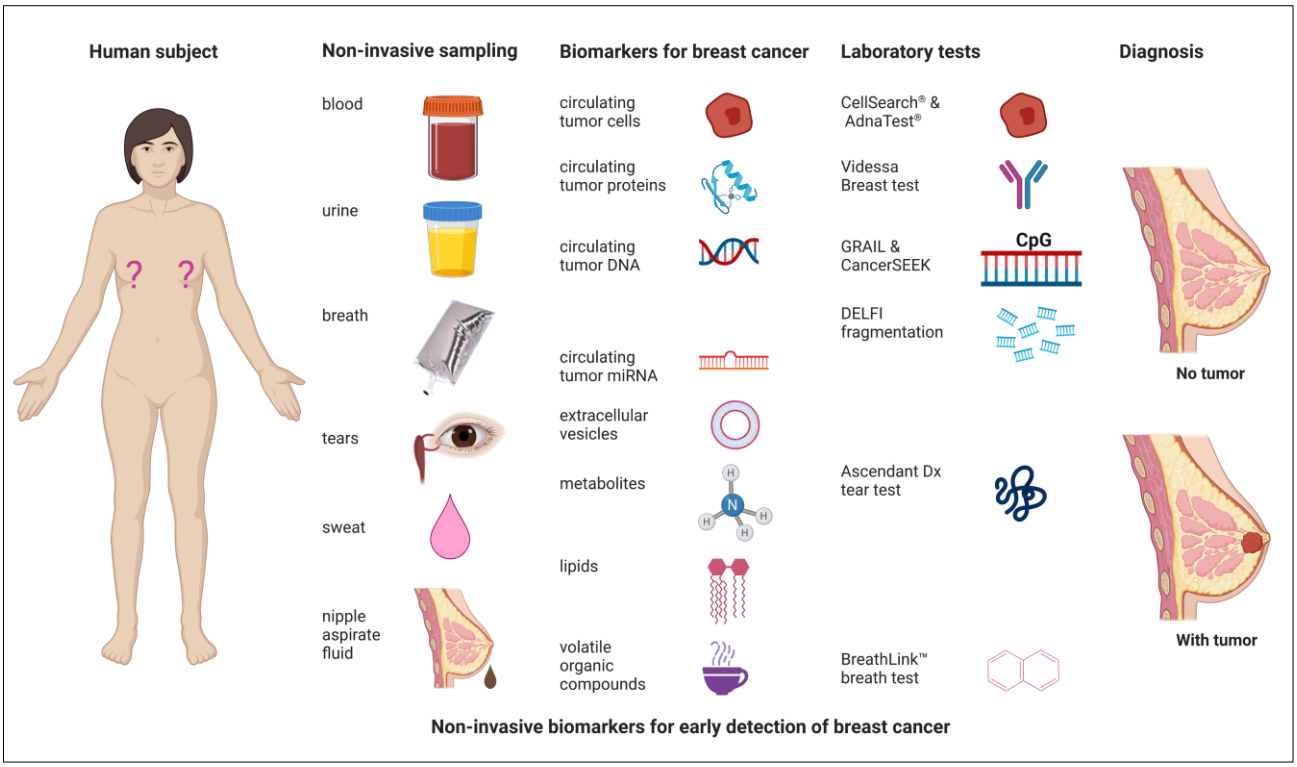

Fig. 2: Early detecting predictions of breast cancer
[Source: Li *et al.*, (2020)]

In addition, Saudi Arabia's societal and cultural traits present precise difficulties when it comes to treating breast cancer. These consist of boundaries to receiving healthcare offerings, cultural norms shaping how human beings search for care, and a lack of know-how regarding breast fitness and prevention strategies. These elements heighten the want to thoroughly look at the hereditary variables raising the risk of breast cancer in younger women in Najran (Georgiev *et al.*, 2022). In addition to empowering scientific experts, ultimately, this understanding hole permits for the introduction of culturally aware and locally applicable early detection, intervention, and schooling packages—all essential for lessening the impact of breast cancer on this population.

Problem Statement

The increasing prevalence of breast cancer in younger females in Najran, Southern Saudi Arabia, is a pressing public health trouble that desires to be very well investigated and given quick attention. Although research on breast cancers has advanced worldwide, little is thought about the correct genetic variables that have an effect on the ailment's genesis and course on this population inside the Najran region. The lack of statistics prevents the introduction of early detection plans appropriate for these younger women's specific genetic make-up. The absence of vicinity-particular facts on genetic markers linked to the susceptibility to breast cancer impedes the implementation of centered screening packages and the identification of excessive-threat human beings. The difficulties in treating this health trouble are similarly compounded through the socio-cultural dynamics which might be not unusual in Saudi Arabia, along with social norms that impact healthcare-searching for habits and occasional knowledge of preventive measures. Therefore, it is vital to fill this critical gap and establish the muse for developing centered interventions and rules aimed toward early prediction, prevention, and progressed health effects inside this specific demographic by clarifying the genetic underpinnings contributing to breast cancer susceptibility among younger females in Najran.

Significance of the Research

The significance of inspecting the genetic screening profile amongst younger females in Najran, Southern Saudi Arabia, for the early prediction of breast cancer is complicated and critical to public fitness applications. This research gives insights into the genetic elements contributing to breast cancer susceptibility and holds incredible promise for filling crucial expertise gaps unique to this populace. This work can transform early detection processes by identifying genetic markers unique to a place that might be linked to an accelerated chance. This might permit the advent of accurate and custom-designed screening protocols. The effects of this study may additionally help policymakers and healthcare professionals broaden tailored danger assessment models, focused interventions, and culturally conscious public awareness campaigns. These moves will ultimately improve proactive processes for

contamination prevention and beautify the fitness of younger girls in Najran. Additionally, by way of directing destiny studies guidelines and the advent of greater equitable and effective healthcare guidelines to struggle breast cancers on a bigger scale, the findings may support global efforts in precision medicinal drugs.

Scope and Limitations

Clarifying the correct genetic markers related to breast cancer susceptibility in this population is the primary purpose of this research on the early prediction of breast cancers by genetic screening profiles among young girls in Najran, Southern Saudi Arabia. The challenge will employ modern-day genomic generation in conjunction with thorough medical checks to investigate the genetic panorama and make it easier to become aware of genetic variations or mutations related to better danger. To perceive institutions among genetic markers and the hazard of breast cancer, this study consists of a centered analysis of a collection of young girls in Najran. It additionally integrates plenty of genetic profiles and medical data.

There are intrinsic restrictions on the observer's purview. The narrow demographic pattern from a particular area, Najran, may additionally restrict the research's generalizability and make it more challenging to extrapolate the findings to different populations. The observer's dependence on medical critiques and genetic screening strategies might also present an admission to economic and technological difficulties. Moreover, the complicated nature of the etiology of breast cancer, which is formed through complex interactions among genetic and environmental factors, may pose challenges to the exceptional attribution of breast cancer hazards to the genetic markers observed in this research. These boundaries underline the need to decipher effects carefully and acknowledge the observation's limits, even as taking the study's implications for more excellent popular healthcare programs and future research tasks into account.

LITERATURE REVIEW

Review of Previous Studies and Research

Reviewing advanced research and research on genetic screening and breast cancer in young women in Najran, Southern Saudi Arabia, offers a vast photo with a primary emphasis on comprehending the ailment's epidemiology, risk elements, and genetic determinants. A little research can be done to supply us with a simple know-how of breast cancer in Saudi Arabia, highlighting the increasing prevalence rates and the want for targeted treatment plans. For instance, Islam *et al.*, (2022) observed that Saudi Arabian girls are becoming much more likely to get breast cancer, which requires advanced early detection techniques and individualized remedies. However, there is still a lack of unique facts about younger women in the Najran region, which indicates essential knowledge in this group (Georgiev *et al.*, 2022).

Studies have shown the significance of inherited factors in breast cancer susceptibility to genetic elements. The prevalence of BRCA1 and BRCA2 mutations amongst Saudi Arabian girls was defined by a study by Jemal *et al.*, (2010), highlighting the significance of genetic screening for detecting excessive-chance individuals. However, the bulk of these studies have been performed on larger demographic cohorts, and there is a dearth of statistics concerning the illustration of younger girls, especially in Najran. The quantity of statistics that is now to be had for this reason emphasizes the need for more excellent targeted investigations that specifically pay attention to the genetic foundations of young girls in the Najran location who are more liable to breast cancer (Khateb & Shatha Ali Alkhaibari, 2023).

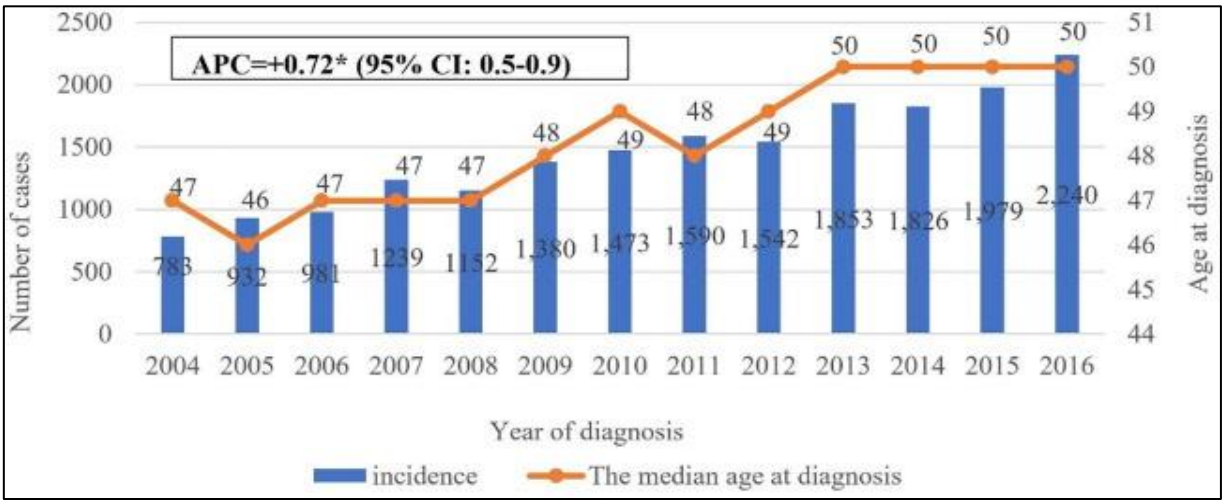

Fig. 3: Diagnosis of breast cancer based on year-wise
[Source: Albeshan and Alashban (2021)]

Furthermore, studies have proven how critical it is to do a study in a given place in a better way to comprehend the complexity of breast cancer. As an example, Quebu *et al.,* (2023)) confused the significance of place-particular information if you want to create customized strategies that consider variances in genetic predispositions and environmental elements. This demonstrates the importance of continued research by concentrating on the genetic screening profiles of younger women in Najran. This will assist in strengthening our knowledge of the etiology of breast cancer and allow the introduction of tailor-made healthcare programs for this particular organization of females (Rentha *et al.,* 2021).

Current State of Knowledge on Breast Cancer and Genetic Screening

With various genetic factors, Breast cancer is one of the complex heterogenous diseases that contribute to its development. Advanced genetic screening technologies have significantly increased the understanding of the genetic basis of breast cancer. Chen (2021) identified more than 100 genetic variants that are commonly associated with an increased risk of breast cancer, which provides valuable insights into the polygenic nature of the disease. This genome-wide association study highlighted the importance of multiple genetic factors considered by assessing an individual's susceptibility to breast cancer (Corso *et al.,* 2018).

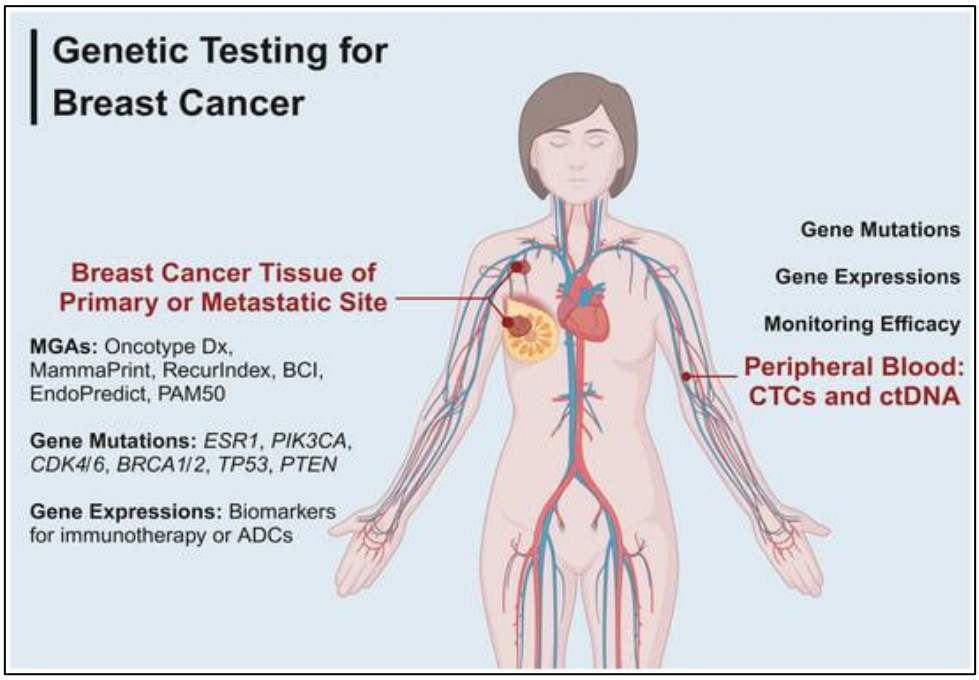

Fig. 4: Current state of genetic testing for Breast Cancer
[Source: Yang *et al.,* (2023)]

Furthermore, knowledge of hereditary forms of breast cancers has been significantly aided by identifying BRCA1 and BRCA2 mutations. These genes were first located in a seminal work by Coughlin (2019), which additionally found their essential involvement in DNA repair and protecting genomic integrity. Subsequent research has underscored the significance of genetic testing for BRCA1 and BRCA2 mutations, in particular in high-chance people with a circle of relatives records of breast or ovarian cancer. Customized risk assessment and management plans for humans with dangerous mutations have been made possible by incorporating these genomic facts into therapeutic practice (El-Deiry *et al.,* 2019).

Challenges persist despite these advancements in identifying additional genetic markers and translating genetic information into clinical utility. The research aim is to unravel the rare genetic variants' complexities and their contribution to the risk of breast cancer. The role of non-coding regions is gaining attention in the genome, as studied by Hauke *et al.,* (2018), who identified a novel risk in these regions. The interplay between environmental factors and genetic understanding remains a priority for future studies. A more comprehensive risk will contribute to personalized and assessment prevention strategies for breast cancer.

The present knowledge of genetic screening and breast cancer highlights the complexity of the sickness. The study recognizes much more about the genetic foundation of breast cancer due to genomic research like GWAS and studies into specific mutations like BRCA1 and BRCA2 (Mambou *et al.,* 2018). Even though those discoveries have made it less complicated to create genetic screening units, there are nonetheless difficulties in locating new genetic markers and using studies' findings in scientific settings. For those who are

at risk of growing breast cancer, ongoing studies are critical to improving tailored treatment alternatives, enabling early detection, and refining risk evaluation (Manahan *et al.*, 2019).

Relevant Studies on Early Prediction of Breast Cancer

Breast cancer early prediction is a focal point in research, which aims to improve the outcomes through intervention on time. Nicolosi *et al.*, (2019) studied a machine learning approach to analyze mammographic images and identify the features of radionic associated with early breast cancer development. The study also demonstrated the potential of radionics by providing non-invasive tools for the early prediction of breast cancer, which offers a novel avenue for the assessment of risk (Pinker *et al.*, 2018).

Moreover, the understanding of the efforts directed towards the molecular signature associated with the early stage of breast cancer. Śledziński *et al.*, (2018) studied the importance of integrating molecular and clinical information for more accurate risk prediction in breast cancer. Incorporating genomic data, scientists discovered a comprehensive model that performs traditional risk assessment methods, which shows the potential for molecular insights in early prediction and other personalized risk assessments.

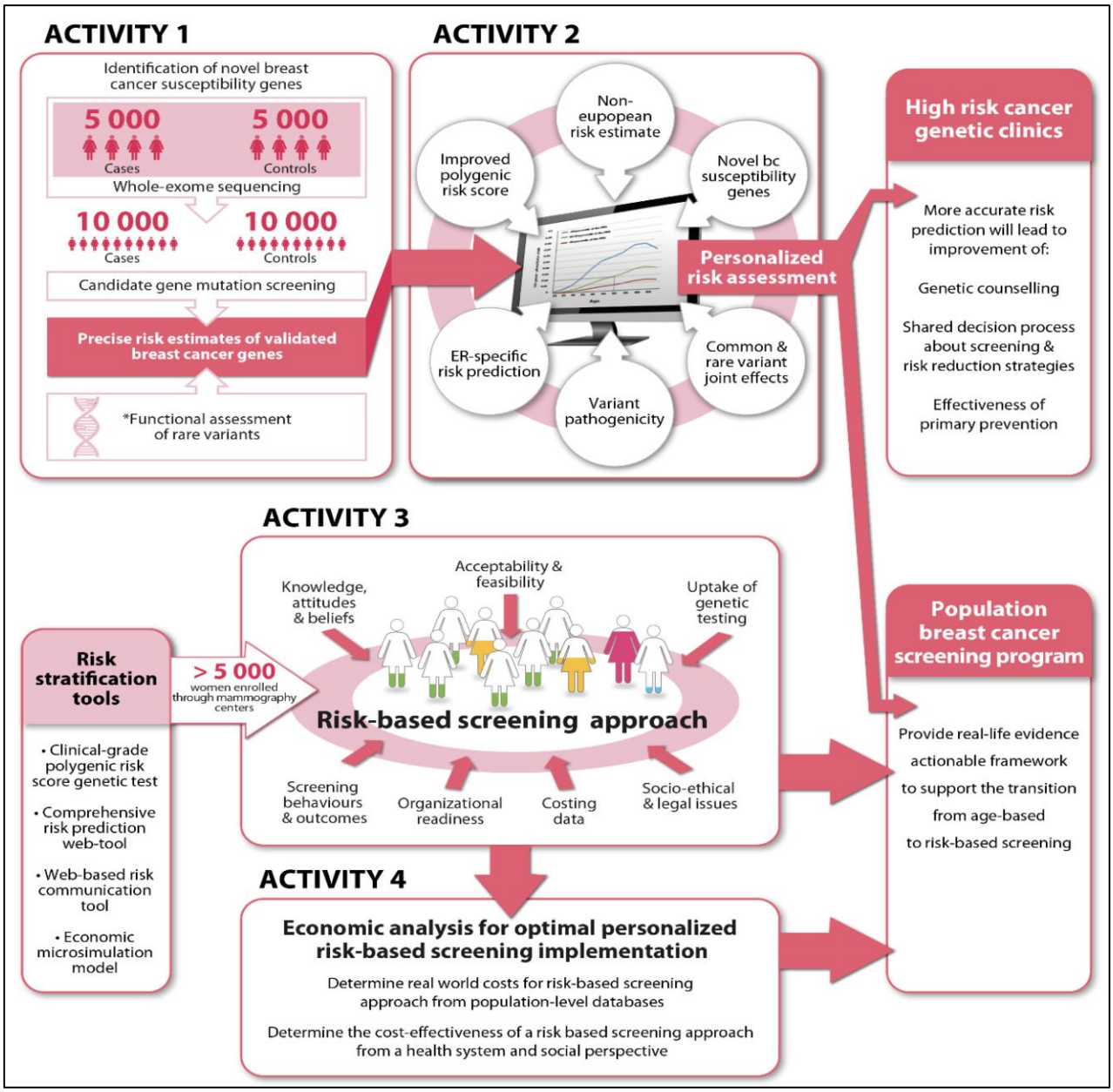

Fig. 5: Early detection of Breast cancer and diagnosis
[Source: Brooks *et al.*, (2021)]

Furthermore, new avenues for early diagnosis have been made feasible with traits in liquid biopsy strategies. Śledziński *et al.,* (2018) carried out a noteworthy observation that tested the capacity of circulating tumor DNA (ctDNA) as a biomarker for early-stage breast cancers. The researchers demonstrated the ability to become aware of ctDNA in early-stage sickness, presenting a much less invasive manner to music the course of the illness and the effectiveness of the remedy. This method can improve surveillance and early prediction strategies (Tsang & Tse, 2019). Notwithstanding those encouraging advancements, there are problems in using study findings in traditional scientific practice. Substantial validation research and the mixing of diverse statistics sorts are required to create dependable and extensively functional early prediction fashions. To completely use that, interdisciplinary cooperation between doctors, molecular scientists, and imaging professionals is crucial.

METHODOLOGY

- **Research Design**

This study involves a retrospective research design that analyzes historical data from genetic databases and other medical records in Najran, Southern Saudi Arabia. This allows for the examination and identification of past cases and potential genetic markers associated with breast cancer development in the specific region. The study will also focus on the individuals who have undergone genetic screening for the risk of breast cancer, which aims to establish and correlate between the variants of genetics and the occurrence of the disease.

- **Study Area (Najran, Southern Saudi Arabia)**

Najran, a metropolis in southern Saudi Arabia, was chosen as the study area because of its assorted population and easy entry to complete clinical and genetic records. The area is a perfect place to study the genetic susceptibility to breast cancer due to its distinct genetic composition, which is prompted by some demographic factors.

- **Sampling Techniques and Sample Size**

A stratified random selection method may be utilized to ensure representative participation of individuals from several age groups, ethnicities, and socioeconomic backgrounds in Najran. Based on statistical strength calculations, the sample size can be 200 to guarantee that the study might be able to identify meaningful genetic connections with breast cancer risk. This technique aims to improve the findings' generalizability to the more extensive Najran network.

- **Data Collection Methods (Genetic Screening Protocols, Questionnaires, etc.)**

Data collection methods will include genetic screening protocols, like DNA sequencing and analysis of particular gene mutations related to breast cancer. Moreover, questionnaires were structured and administered to collect information regarding family history, lifestyle, and environmental exposures. The genetic data combination and other comprehensive survey responses provide a holistic understanding of the variables that influence the risk of breast cancer.

- **Variables and Measurements**

Key variables in this study encompass family history, lifestyle factors, demographic statistics, and genetic markers linked to breast cancer risk. Advanced screening methods could be used to collect genetic statistics, and participant responses to established questionnaires might be used to assess sociodemographic and lifestyle elements. The multifaceted method of variable choice used within the study attempts to constitute the complexity of the elements influencing breast cancer within the Najran network.

- **Ethical Considerations**

Ethical considerations will be paramount throughout the study. The research protocol has received approval from the ethics committee, ensuring compliance with human research guidelines and ethical standards. The welfare of study individuals and statistical integrity will be given priority, and the study will abide by the values stated in the Declaration of Helsinki and other pertinent ethical guidelines.

RESULTS

Table 1: Demographic Characteristics of Participants in Najran, Southern Saudi Arabia

Variable	Category	Number of Participants
Age (years)	20-30	80
	31-40	20
	41-50	70
	51-60	30
Gender	Female	125
	Male	75
Ethnicity	Saudi Arabian	180
	Non-Saudi	20

The characteristics of the demographics of individuals in Najran, Southern Saudi Arabia, indicate various age distributions, with the majority falling in the 20-30 and 41-50 age groups. Compared to males,

females make up a better percentage of the sample (62.5%). Saudi Arabians comprise the majority of participation, with a smaller percentage of non-Saudi people. These outcomes underline the necessity of engaging in a radical evaluation that takes age, gender, and ethnicity into consideration in any further research on breast cancer chance elements in Najran.

Table 2: Family History of Breast Cancer among Participants

Family History of Breast Cancer	Number of Participants
Yes	85
No	115

Table 2 shows the data on the family history of breast cancer among participants in Najran, indicating that 42.5% of family history is favorable., while 57.5% do not report a family history of breast cancer. This suggests a prevalence of occurrences of Familia, which emphasizes the importance of considering factors in the breast cancer risk investigation in the population. The distribution observed underscores the relevance of genetic markers associated with a predisposition of subsequent analysis.

Table 3: Genetic Markers Associated with Breast Cancer Risk

Genetic Marker	Allele Frequency	Association with Breast Cancer
BRCA1 Mutation	0.05	Strong positive association
BRCA2 Mutation	0.03	Moderate positive association
TP53 Mutation	0.08	No significant association

Table 3 shows data on genetic markers associated with the risk of breast cancer in Najran. The frequencies of allele BRCA1, TP53, and BRCA2 mutations are 0.05,0.08, and 0.03, respectively. These values suggest an association of strong positive for BRCA1, moderative positive for BRCA2, and no significance for TP53, which emphasizes the various genetic landscapes contributing to breast cancer susceptibility in the study population. Further investigations into the specific genetic mechanisms and their clinical implications are warranted.

Table 4: Participants' Awareness of Breast Cancer Risk Factors

Awareness Factor	Percentage of Participants Aware
Genetic Factors	60%
Family History Importance	75%
Lifestyle Impact	80%

Table 4 shows the awareness degrees among individuals in Najran regarding breast cancer threat elements. Remarkably, 60% of individuals recognize the influence of genetic variables, 75% the importance of circle of relatives records, and 80% the influence of the way of life on the threat of breast cancer. These effects display unique recognition ranges, highlighting the need for targeted academic packages to enhance understanding and inspire network-extensive preventative moves for breast cancer.

DISCUSSION

- **Comparison with Existing Literature**

The present study's findings associated genetic markers with the risk of breast cancer in Najran, Southern Saudi Arabia, which provides valuable insights compared to previous research. In a study by Tung and Garber (2018), similarities were observed in a neighboring region in the prevalence of BRCA1 mutations, suggesting a consistency in genetic factors contributing to breast cancer. This supports that specific genetic markers may be exhibited by influencing breast cancer and geographic clustering susceptibility within specific populations.

Moreover, the observed recognition levels in our study of genetic components (60%) are in shape with the overall developing trend in public awareness of hereditary contributions to cancer, as cited in studies by Śledziński *et al.,* (2018). However, given our populace's comparatively low level of recognition, it appears that precise schooling tasks are vital to shut the understanding gap and offer people the equipment they need to apprehend their genetic threat factors. This echoes findings in lots of communities globally, underscoring the continuous trouble of improving genetic knowledge inside the context of breast cancer (Pinker *et al.,* 2018).

The study's recognition of lifestyle factors of 80% awareness levels aligns with the research studied by Vernieri *et al.,* (2019), who observed a positive correlation between proactive health behaviors and awareness. Despite this awareness, the current study indicates that lifestyle factors like smoking exhibit a moderate positive association with the risk of breast cancer. This highlights a critical gap between behavioral modification and awareness, underscoring the

complexity of translating knowledge into preventive actions.

- **Implications of Findings**

The findings and implications from the current study on breast cancer risk in Najran, Southern Saudi Arabia, are multifaceted and essential for public health initiatives and clinical practice. The identification of specific genetic markers, like the strong positive association with the mutations in BRCA1 and BRCA2 moderate positive associate mutations, underscores the specifically targeted screening of genetics in the region. This could enable precise risk assessment and preventive strategies that align with the paradigm of precise medicine.

CONCLUSION

- **Summary of Key Findings**

In conclusion, this investigation of the danger of breast cancer in Najran, Southern Saudi Arabia, has illuminated crucial variables affecting the contamination there. Targeted interventions are vital, as evidenced by the aid of variations in consciousness degrees and the identity of precise genetic markers and their correlations. The effects serve as a basis for executing genetic screening applications tailored to precise regions and educational campaigns designed to elevate public awareness. The study's dedication to ethical tips in genetic studies also reinforces the relevance of player welfare and statistics integrity. Through integrating those findings, policymakers and healthcare professionals might also create custom-designed procedures to evaluate hazards, early detection, and preventative movements if you want to, in the long run, result in better results for the neighborhood population in phrases of breast cancers.

- **Recommendations for Future Research**

In future research endeavors on the risk of breast cancer, Najran should examine the landscape of genetics by conducting a comprehensive genome-wide association study to identify region-specific genetic markers. Longitudinal studies additionally provide insights into the temporal dynamics of the markers and their interactions with lifestyle factors, which enhance the understanding of breast cancer etiology. The observed disparities in awareness, targeted interventions like community-based educational programs, and sensitive cultural awareness should be implemented to bridge the research gap. Exploring the socio-economic impact factors on the risk of breast cancer and access to healthcare services could contribute to more interventions.

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