FMDB *Transactions on Sustainable Health Science Letters*

Analysing Healthcare Disparities in Breast Cancer: Strategies for Equitable Prevention, Diagnosis, and Treatment among Minority Women

Zainab Bala Kuta[1,*], Rejwan Bin Sulaiman[2]

[1]Department of Computing, Arden University, Middlemarch Park, Coventry, United Kingdom.
[2]Department of Computer Science and Technology, Arden University, Middlemarch Park, Coventry, United Kingdom.
stu62207@ardenuniversity.ac.uk[1], rbsulaiman@arden.ac.uk [2]

Abstract: Breast cancer remains a leading cause of mortality among women in the United States. Despite advancements in treatment and medical technology, studies have revealed persistent disparities in breast cancer detection, management, and outcomes for ethnic minority groups. This research focuses on African American, Hispanic, and Native American women, who are more likely to be diagnosed with breast cancer and have lower survival rates. These disparities are believed to stem from barriers to accessing quality healthcare and social, economic, and cultural factors. The study utilized the November 2017 version of the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) database, which provides population-based cancer statistics. A dataset comprising 4,024 female patients diagnosed with infiltrating duct and lobular carcinoma breast cancer between 2006 and 2010 was analysed using descriptive and inferential statistics, including correlation and regression analysis, to ensure data validity and reliability. The research investigates the impact of race on female breast cancer patients in the United States. It aims to elucidate the persistent disparities in incidence, treatment, and outcomes of the disease for women of colour. Addressing these issues is crucial to establishing equitable and effective strategies for breast cancer prevention, diagnosis, and treatment.

Keywords: Healthcare Disparities; Race and Breast Cancer; Equitable Prevention; Diagnosis and Treatment; Minority Women; Black and Minority Ethnic (BME); Healthcare and Socioeconomic Status; Insurance Coverage.

Received on: 21/01/2023, **Revised on:** 05/04/2023, **Accepted on:** 12/07/2023, **Published on:** 03/12/2023

Cite as: Z. Bala Kuta, and R. Bin Sulaiman, "Analysing Healthcare Disparities in Breast Cancer: Strategies for Equitable Prevention, Diagnosis, and Treatment among Minority Women," *FMDB Transactions on Sustainable Health Science Letters*, vol. 1, no. 3, pp. 130 –143, 2023.

1. Introduction

Breast cancer is widely acknowledged as the most generic form of Cancer among women, regardless of their ethnic backgrounds. While the diagnosis and treatment of this disease pose challenges and stress for any individual, the specific impact on Black and Minority Ethnic (BME) women has received limited attention in the existing literature. Previous research has focused on documenting the physical, psychological, and social consequences of breast cancer, but few studies have considered the role of race. Although there are similarities in the treatment of White and BME women, race also influences certain unique aspects. Therefore, this study aims to investigate the racial disparities in treatment and survival outcomes for female breast cancer patients in the United States. Over the years, significant research efforts have been dedicated to understanding Cancer, which is a leading cause of death worldwide. Extensive investigations have been conducted to comprehensively understand tumour biology, progression, invasion, and metastasis [29]. According to experts in the field, Cancer is characterized by the abnormal growth of cells in the body resulting from changes in normal cells. This abnormal cell growth can lead to a lump or mass formation [30]. If the mass is cancerous and invades surrounding healthy tissues, it can cause severe complications.

[*]Corresponding author.

Conversely, if the mass is benign and does not spread to other tissues, it will not invade neighbouring areas. It is estimated that there are more than two hundred types of Cancer, including lung cancer, bowel cancer, ovarian cancer, bone cancer, brain tumours, cervical Cancer, leukaemia, skin cancer, and others [8].

1.1. Project Background

Research suggests that before the 1980s, breast cancer mortality rates in the United States remained steady, with mastectomy being the primary treatment approach. However, the introduction of screening mammography and the use of adjuvant systemic therapy in the 1980s brought about a significant decline in breast cancer mortality. Despite this progress, a notable racial disparity emerged, as Black and Asian women did not experience the same benefits as White women and had higher rates of HR-negative tumours, which have a poorer prognosis. Reports indicate that between 2014 and 2018, HR-negative Cancer accounted for 56% of the variation in breast cancer fatalities between Black and White women. Therefore, it is crucial to prioritize research on breast cancer prevention and treatment to reduce racial disparities and overall breast cancer mortality worldwide.

Additionally, improving access to high-quality medical care for Black and Asian women can help narrow the racial gap in breast cancer mortality in the United States, where the overall incidence of the disease is lower compared to White women [19]. It is widely recognized that breast cancer affects women from diverse ethnic and racial backgrounds, but the occurrence and consequences of the disease can vary among different racial groups. Several studies indicate that African American women have a higher mortality rate from breast cancer compared to white women, even when considering factors such as access to healthcare and socioeconomic status. This difference may stem from disparities in tumour biology, delayed diagnosis, or inadequate access to proper treatment. Women from Asian, Hispanic, and Native American backgrounds also face an increased risk of developing certain subtypes of breast cancer [35].

1.2. Project Aim, Scope, and Objectives

The primary focus of this project is to investigate the differences in treatment and survival outcomes among female breast cancer patients in the United States based on race. Despite advancements in breast cancer treatment and research, disparities in outcomes and access to care persist across various racial groups. The study aims to examine the impact of race on the treatment and outcome of breast cancer in female patients, with a specific focus on the racial groups of Black, White, and Other (Asian/Hispanic). The project will address the following key aspects:

- The examination of the effects of race on the treatment and outcome of female breast cancer patients in the United States.
- Identifying the contributing factors that contribute to disparities between different racial groups.
- Gaining insight into the extent of racial disparities in the diagnosis, treatment, and outcome of female breast cancer patients.
- Highlighting the key factors, such as access to healthcare, cultural beliefs, and socioeconomic status, contribute to these disparities.
- Analysing the effectiveness of current strategies aimed at reducing or eliminating racial disparities.
- Developing effective strategies to ensure equitable and high-quality breast cancer care for all women, regardless of their race or ethnicity.

2. Literature Review

It is widely acknowledged among scholars that Cancer is not a single disease but rather a diverse group of more than a hundred distinct illnesses. Cancer occurs when cells in a specific body part start growing uncontrollably and can affect various areas [24]. Recent research indicates that Cancer remains a leading cause of death worldwide and a significant barrier to increasing life expectancy [25]. According to the World Health Organization (WHO), in 2019, Cancer was either the leading or second-leading cause of death before the age of 70 in 112 out of 183 countries. Additionally, it ranks as the third or fourth leading cause of death in an additional twenty-three countries. The global incidence and mortality rates of Cancer are rapidly increasing due to population growth and aging [35].

A study projected that in 2022, there will be approximately 4,820,000 new cases of Cancer in China and 2,370,000 new cases in the USA. The study also estimated 3,210,000 cancer-related deaths in China and 640,000 deaths in the USA. These estimates were based on cancer data from GLOBOCAN 2020 and population data from the United Nations [39]. Scholars commonly agree that advancements in understanding cancer biology have significantly improved cancer prevention, early detection, and treatment [26]. It can be argued that in the past two decades, researchers and scientists have gained more knowledge and

understanding of Cancer than in all the preceding centuries. Nevertheless, it is crucial to acknowledge that all scientific progress is built upon the discoveries and efforts of those who came before us.

Breast cancer is a common type of Cancer that affects breast tissue, primarily in women but also rarely in men. It can be either benign or malignant, with malignant tumours potentially spreading to other parts of the body. The most prevalent form of malignant breast cancer is invasive ductal carcinoma, which starts in the cells lining the breast ducts and can extend to nearby tissues [27]. Factors such as age, gender, family history, exposure to certain elements like Estrogen, and specific genetic mutations increase the risk of developing breast cancer [37]. Early detection and access to quality medical care are crucial for improving outcomes. Ongoing research is vital in enhancing our understanding of the disease's biological mechanisms and developing new treatments [28].

According to Sung et al. [34], breast cancer accounted for 2.2 million new cases in 2020, representing approximately one-tenth of all diagnosed cancers that year. It caused 684,996 deaths, with a higher mortality rate in low-resource areas. Early detection and treatment significantly enhance survival rates, but a substantial proportion of breast cancer cases (50-60%) are diagnosed at an advanced stage, making treatment more challenging and costly [36]. Despite decades of research, the incidence of breast cancer is increasing, and it remains the leading cancer-related cause of disease burden for women. Globally, breast cancer affects one in twenty women and up to one in eight women in high-income countries [6]. Another study suggests that reducing breast cancer incidence in high-income countries requires a combination of population-based measures to minimize exposure to risk factors and precision-prevention strategies targeting women at higher risk for tailored interventions. However, implementing these strategies on a broad scale has faced significant challenges.

Breast cancer is typically diagnosed between the ages of 41 and 50, according to Zodinpuii et al. [11]. Risk factors include consuming fermented pork fat, smoked food, and smokeless tobacco, having a family history of Cancer or hereditary diseases, and having a low intake of vegetables and water. However, these findings are limited to a specific ethnicity (Mizo-Mongoloid women in Northeast India) and focus only on the association of risk factors and inherited diseases with breast cancer. Thus, caution is needed in interpreting these results as they do not comprehensively represent breast cancer outcomes due to their narrow sample and focus.

Similarly, Johansson et al. [21] found that hormonal factors and age influenced the risk of the most common benign breast diseases (BBDs) in women in Sweden. A family history of breast cancer was associated with the risk of both proliferative and non-proliferative BBDs. However, these findings cannot be generalized to all patients, and further research is needed to gain a better understanding of breast diseases.

According to the International Agency for Cancer Research, breast cancer has surpassed lung cancer as the most diagnosed Cancer globally, with approximately 2.3 million new cases (11.7%) reported in 2020 [35]. In the UK, it is the most prevalent type of Cancer. Although most women diagnosed with breast cancer are over fifty, younger women can also be affected. About one in eight women will receive a breast cancer diagnosis during their lifetime, and early detection improves the chances of recovery.

Women should regularly check their breasts for any changes and consult a GP if they notice any differences [27]. A study found that women from lower income brackets face barriers to completing mammography screening, with transportation being a major obstacle and fear hindering follow-up after abnormal screening [9]. Late detection of breast cancer in Addis Ababa has been linked to the use of traditional medicine and delays in diagnosis, emphasizing the need for interventions at the community and health systems levels [13]. Drug resistance poses a significant challenge in treating breast cancer and contributes to high mortality rates [31]. Access to care predicts patient satisfaction, but findings may not fully address access issues in under-resourced clinics [7]. Projections indicate a rise in breast cancer cases and deaths, underscoring the ongoing need for research, prevention, and treatment efforts [2]. Racial disparities in breast cancer mortality exist, with factors such as lack of insurance, fear of testing, and unequal distribution of resources contributing to the disparities [3]. However, addressing the root causes of these disparities at the policy level is necessary.

2.1. Breast Cancer and Race

According to recent census data in the United Kingdom, non-white groups comprise 15% of the population, and the most significant minority groups are individuals of Indian, Pakistani, Black Caribbean, and Black African origin [12]. Suppose Baird et al. [4] findings are accurate. In that case, some significant variations and similarities hinder the timely detection of breast cancer among Black African, Black Caribbean, and White British women in the UK. The researchers suggested that it is necessary to restructure health promotion efforts to encourage early reporting of breast cancer symptoms and collaborate with communities to produce culturally suitable resources that may decrease social taboos and stigma. They also added that increasing discussion of breast cancer and promoting help-seeking for breast symptoms among women with low cancer

awareness. However, in as much as the research included Black and White women in the study, other ethnicities, such as Asian women were not captured. Therefore, it is important to consider the possible bias in these responses, and the generalisability of much-published research on this issue is problematic.

A recent study suggests that the experiences of breast cancer among Black and South Asian women are influenced by cultural concerns, highlighting the need for culturally sensitive care [22]. However, caution must be exercised as the study primarily included Black Caribbean and Indian women, and the experiences may not represent the entire Black and South Asian population, particularly those with limited English proficiency. Another study focused on young Black women in the UK, revealing more unfavorable characteristics and aggressive treatment in this group, but the findings cannot be extrapolated to all patients [37]. Similarly, a study on breast cancer survival between White and Black Americans demonstrated disparities, but the findings may not be generalized as it was conducted in a single institution [23]. These studies would benefit from including other ethnic groups to provide a more comprehensive understanding.

2.2. Disparities between Race and Breast Cancer

Based on data from the US Census region, age group, and race between 1999 and 2020 suggested that disparities in breast cancer have remained consistent over the past two decades. Ellington et al. [10] hold the view that utilising top-notch cancer surveillance information for analysing patterns in the rate of breast cancer deaths can aid healthcare providers and public health initiatives in customizing their screening and diagnosis methods to address the inequalities [11]. According to Zhong et al. [20], the difference in the rates of surgery for Black and White patients decreased, as evidenced by the adjusted odds ratio (aOR), which decreased from 0.621 (0.592-0.652) in 2007 to 0.734 (0.702-0.768) in 2015. However, a recent study suggests that the disparity based on race still exists in the rates of surgery for lung, breast, prostate, and ovarian cancers.

There is some evidence to suggest that the difference in breast cancer mortality rates between Black women and White women in the US varies significantly, and this is partly attributed to the difference in how states enable universal access to high-quality healthcare [20]. It is believed that this could be due to the absence of health insurance, which can limit the ability to access prompt and effective medical treatments. According to Giaquinto et al. [14], the incidence of breast cancer continues to increase slowly in the United States despite the lower incidence. Black women have a lower incidence of breast cancer, and they experience a 40% higher mortality rate compared to White women [15]. Moreover, this difference has persisted for the last ten years despite increased awareness within the oncology field [16]. The study would have been more relevant if other ethnic groups had been included; these results should be interpreted cautiously. If Gathani et al. [12] findings are accurate, women from ethnic minority groups exhibit more aggressive forms of breast cancer compared to White women.

3. Methodology and Methods

The research involved the collection and analysis of data from various sources using various methods, including surveys, interviews, and medical records of female breast cancer patients [17]. Figure 1 below displays the visual representation of the research plan and what was discussed in the following chapters.

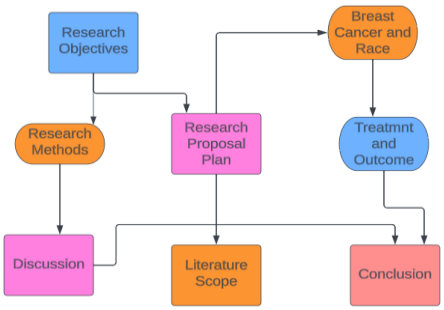

Figure 1: Research Plan

A recent report suggests that there are significant global inequalities in the allocation and availability of top-quality treatment, which impacts the outcomes of many individuals with breast cancer. Barrios [5] holds the view that the primary focus ought to be the timely and accurate diagnosis of breast cancer and the provision of suitable and timely treatment. Figure 2 below displays the flowchart of the research design, steps, and procedures involved in the methodological processes. As indicated previously, the next section looked at methodology.

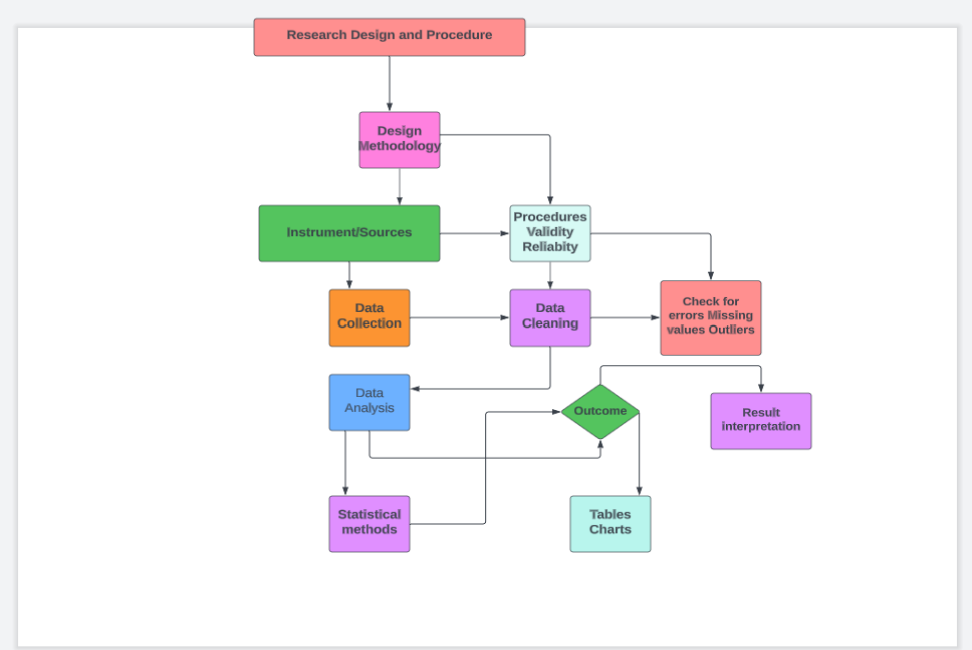

Figure 2: Research Design Flowchart

Figure 2 is a visual representation of the methodology process used in the study. The figure includes a flowchart that describes the steps taken to ensure the validity of the results.

4. Methodology

Data was extracted utilizing convenience sampling, resulting in a cross-sectional design that reflects the population at only a single point in time. However, conducting a longitudinal study can be challenging due to the resource-intensive nature of collecting several data sets and the difficulty retaining the same subjects for multiple interviews. Due to time and resource constraints, the current study was limited to a cross-sectional design. The variables studied in this research included age (at the time of diagnosis), Race (White, Black, and Other), Marital Status (Single, Married, Separated, Divorced and Widowed), T Stage (T1, T2, T3, and T4), N Stage (N1, N2, and N3), 6th Stage (IIA, IIB, IIIA, IIIB, and IIIC), Grade (Grade I – well differentiated, Grade II – moderately differentiated, Grade III – poorly differentiated, and Grade IV - undifferentiated, Tumour size, Estrogen Status (Positive and Negative), Progesterone Status (Positive and Negative), Regional Nodes Examined, Regional Nodes Positive, Survival Months, and Status (Alive and Dead). In total, the sample size in this study is 4,024 patients. The data for this study was obtained from the November 2017 update of the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) database. It is open access, and users can extract the dataset when required; it is accessible through the link [18]. Obtaining a sampling frame for a large population can be difficult [1]. Resources limited the researcher, so it was not feasible to use a probability sampling design, such as simple random sampling, without a valid sampling frame. Instead, the researcher used a convenience sampling design. The tables below show an overview of the dataset.

Table 1: Age, Race, Marital Status

	Age	Race	Marital Status	T-Stage	N-Stage	6th Stage
0	68	White	Married	T1	N1	IIA
1	50	White	Married	T2	N2	IIIA
2	58	White	Divorced	T3	N3	IIIC
3	58	White	Married	T1	N1	IIA
4	47	White	Married	T2	N1	IIB

Table 1 shows the collection of demographic and medical information on women with breast cancer:

- Age: This refers to the age of women in the sampled population, measured in years.

- Race: This refers to the race or ethnicity of the women in the sampled population, categorised by White, Black, and Other (Asian, Hispanic).
- T Stage: This measured the size and the extent of the primary tumour in women, as classified by the TNM staging system. It varies from T0 - which means no evidence of primary tumour, to T4, which indicates that the tumour has invaded nearby tissues.
- N Stage: This measured the extent of lymph nodes involved in women with the disease; it varies from N0 - which means no evidence of lymph node involvement to N3 – which indicates that the tumour has spread to nearby lymph nodes.
- 6th Stage: This refers to the overall cancer stage of women with the disease; it varies from Stage 0 – meaning in situ cancer to Stage IV - indicating that the Cancer has spread to other parts of the body.

Table 2: Differentiation of Grade and Tumour Size

	Differentiation	Grade	A-Stage	Tumour Size	Estrogen Status
0	Poorly differentiated	3	Regional	4	Positive
1	Moderately differentiated	2	Regional	35	Positive
2	Moderately differentiated	2	Regional	63	Positive
3	Poorly differentiated	3	Regional	18	Positive
4	Poorly differentiated	3	Regional	41	Positive

Table 2 is a collection of medical information for a group of individuals with a particular type of Cancer, breast cancer. Here is an explanation of the different variables:

- Differentiated: This refers to the degree of differentiation or maturity of the cancer cells. Differentiated tumours have cells that look more like normal cells, while poorly differentiated tumours have cells that look quite different and abnormal.
- Grade: This measured the aggressiveness of the cancer cells. Tumours are graded on a scale of 1 to 3, with grade 1 being the least aggressive and grade 3 being the most aggressive.
- A Stage: This refers to the tumour stage. The A stage considers the size of the tumour, whether it has spread to nearby lymph nodes, and whether it has metastasized to other parts of the body.
- Tumour Size: This refers to the size of the tumour. Tumour size is a crucial factor in determining the stage of Cancer and the appropriate treatment options.
- Estrogen Status: This refers to whether the cancer cells are Estrogen receptor-positive or Estrogen receptor-negative. Estrogen is a hormone that is believed to promote the growth of some types of breast cancer cells; therefore, knowing the Estrogen status of the tumour could help guide the treatment decisions.

Table 3: Progesterone Status, Regional Node Examined

	Progesterone Status	Regional Node Examined	Regional Node Positive
0	Positive	24	1
1	Positive	14	5
2	Positive	14	7
3	Positive	2	1
4	Positive	3	1

Table 3 is a collection of medical information for a group of individuals with a particular type of Cancer, breast cancer. Here is an explanation of the different variables:

- Progesterone Status refers to whether the cancer cells are progesterone receptor-positive or progesterone receptor-negative. Progesterone is another hormone that can promote the growth of some types of breast cancer cells.
- Regional Node Examined: This refers to the number of regional lymph nodes examined during the surgical removal of the tumour. Many in the field believe that the lymph nodes are important for filtering out bacteria and other foreign substances from the body; however, they can also be a site of the spread of Cancer.

- Regional node positive: This refers to the number of regional lymph nodes that were found to contain cancer cells. Many scholars believe that if the cancer cells have spread to the lymph nodes, it could indicate a higher risk of Cancer spreading to other parts of the body and may affect treatment decisions.

Rosenhaim et al. [32] suggest that high-quality data sets should be employed when embarking on any analysis, stating that careful data preparation facilitates user access to all processed data, reduces the possibility of errors and inaccuracies that could occur during data processing, and leads to more effective analysis. IBM SPSS Statistical tool was used to conduct the data analysis of this study [33]. SPSS was selected for data analysis because it allows people of all technical backgrounds to clean and validate the data themselves without needing to be experts. Before proceeding to the actual data analysis process, it is important to understand the significance of data preparation. Data preparation is a major factor in data analysis. Data validation is not an easy task; however, removing flawed data and filling in any gaps is important, which leads us to the next topic of quantitative data [38]. Many scholars believe that quantitative data often require initial preparation and calculating composite measures to achieve a valid and reliable outcome. SPSS, a statistical software package, was used to analyze quantitative data. After the data was extracted from all the necessary sources, it was cleaned and sorted by identifying and purging duplicates, anomalous data, and other inconsistencies that could skew the analysis to generate accurate results. The main process regarding data cleaning that was executed included:

- Removed errors, duplicates, and issues encountered while aggregating data from multiple sources.
- Non-essential data points and non-relevant information unrelated to the proposed analysis were removed.
- Managed layout problems, typos and mapped data in a simpler and readable manner.
- Identified and filled the gaps – added missing values.
- Private or confidential data were hidden.
- Spelling mistakes were checked and corrected.
- Once the data had been sorted, the validated process began to determine if any error had occurred during the data preparation process. Human error is likely to happen during this phase; hence, correcting it before moving forward is necessary.

The study compared demographic, clinicopathologic, and treatment data of different races, including age variations, year of diagnosis, stage of disease, tumour grade, and marital status. The Chi-square test was used for comparison. Kaplan-Meier estimates were employed to analyse the overall survival (OS) and disease-specific survival (DSS). The study utilized Cox regression multivariate analysis to identify independent predictors for OS. A statistically significant result was considered as a two-sided p-value <0.05. However, collecting data from every unit in the population was impossible. Hence, a sample was extracted to represent the population. The technique and procedure of extracting sampled units from the target population were discussed and justified.

5. Result and Discussion

The study's results were presented and analysed into sections using various charts and tables. Furthermore, discussions were held to evaluate the trends and correlations observed in the study, as shown below.

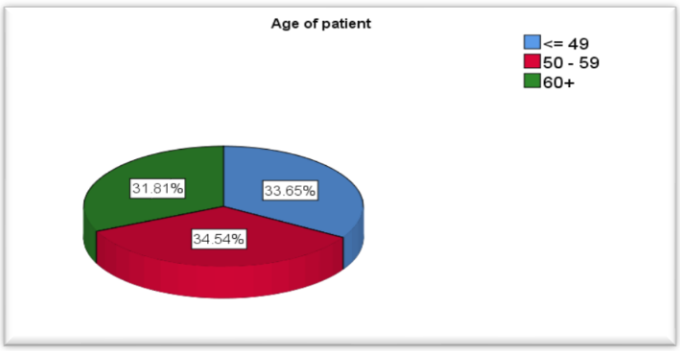

Figure 3: Pie chart of patient's age

Figure 3 shows the pie chart of the age of female breast cancer patients. There is some evidence to suggest that age is a key factor that can influence the diagnosis and treatment of breast cancer in women. As women grow older, their risk of developing breast cancer increases. This suggests that the age of a patient can play a significant role in the diagnosis and treatment of breast cancer.

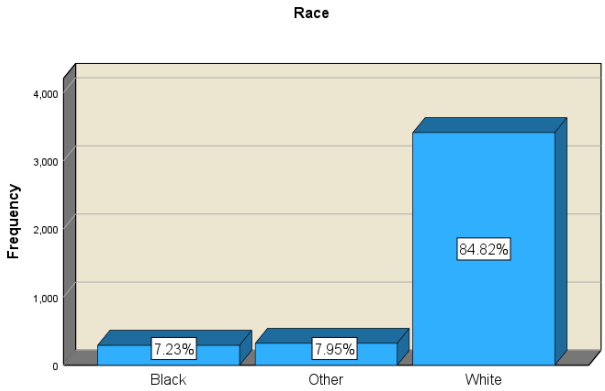

Figure 4: Race of the patient

Figure 4 displayed the bar charts of female breast cancer by race. According to the result, almost 85% of Breast Cancer patients are from the White Race, 8% are from the Black race, and 7% from the Other Race. In the context of health, race can impact access to healthcare and the diagnosis and treatment of various diseases, including breast cancer.

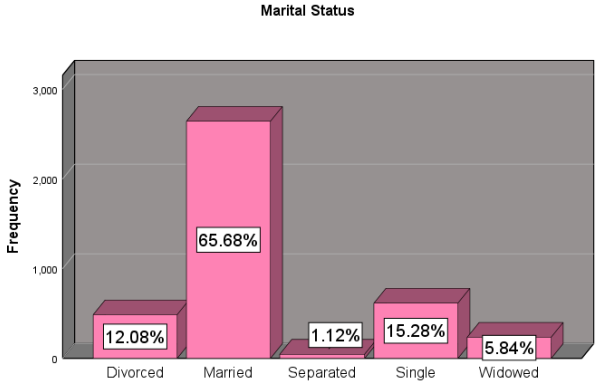

Figure 5: Bar chart of Marital Status

Figure 5 is the bar chart of the sampled population according to their marital status. 65.7% are married, 15.3% are single, 12.1% are divorced, and 5.8% are widowed. More than 66% of Breast cancer patients are married. Then followed by Divorce (15%), single (12%), widowed (6%) and Separated (11%).

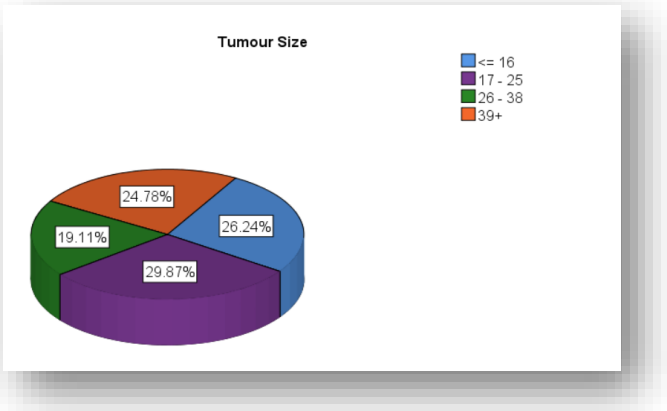

Figure 6: Pie chart of Tumour Size

Figure 6 showed different tumour sizes in millimeters. 26.2% have tumour size range of less or equal to 16mm, 29.9% with a range between 17 – 25mm, 19.1% between 26 – 38mm, and 24.8% have more than 39mm. Many scholars hold the view that tumour size is a crucial factor in the diagnosis, prognosis, and treatment of breast cancer. Larger tumors are more likely to have spread to nearby tissues and lymph nodes, resulting in a lower likelihood of successful treatment.

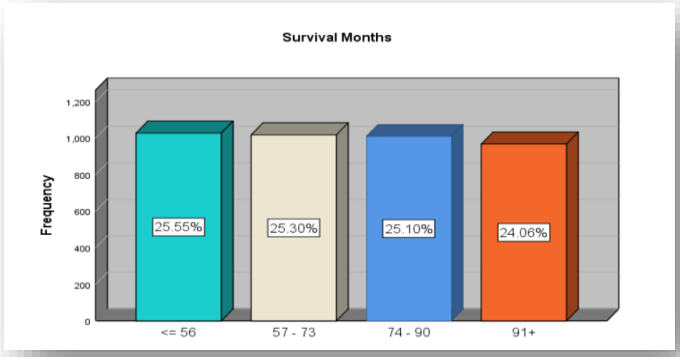

Figure 7: Bar chart of Survival Months

Figure 7 shows that 25.5% of the sampled population have survival months of less or equal to 56 months, 25.3% with 57 – 73 months, 25.1% with 74 – 90 months, and 24.1% with more than 91 months. The five-year survival rate for early-stage breast cancers is over 90%, while the five-year survival rate for late-stage breast cancers is around 26%.

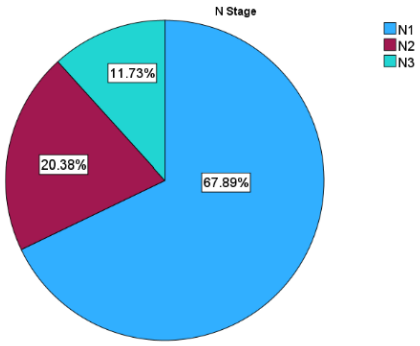

Figure 8: Pie chart of N Stage

Figure 8 is the bar chart displaying the results in percentages. The term "N" pertains to the count of neighbouring lymph nodes that are affected by Cancer. Meanwhile, the classifications N1, N2, and N3 are used to identify the number and specific location of lymph nodes harboring cancer cells.

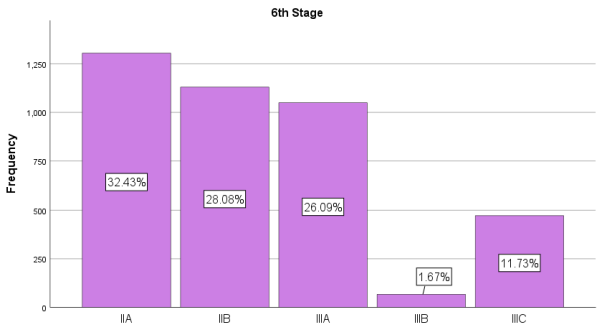

Figure 9: Bar chart of 6th stage

According to Figure 9, a substantial proportion of the sampled population (32.4%) have stage IIA, considered an early stage. 28.1% have stage IIB, while 26.1% have stage IIIA, both considered intermediate stages. A small proportion (1.7%) have stage IIIB, while 11.7% have stage IIIC, which is considered advanced stage grade.

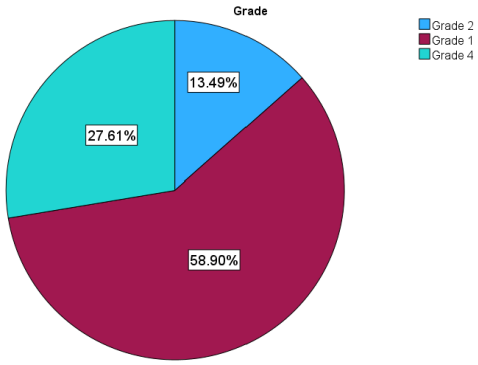

Figure 10: Pie chart of Grade

Figure 10 is the bar chart displaying the results in percentages. There is evidence to suggest that the grade of Cancer is different from the cancer stage. It has been reported that grade refers to the appearance of the cancer cells under a microscope and is used to determine how aggressive the Cancer is. A high-grade cancer is considered more aggressive and is likely to grow and spread more quickly than low-grade Cancer.

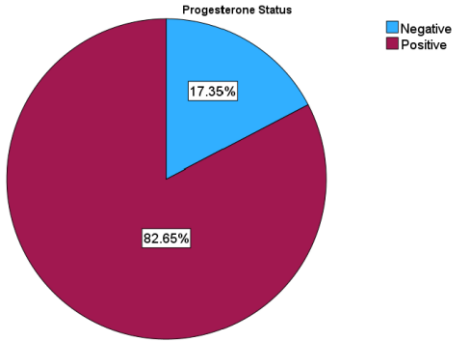

Figure 11: Pie chart of Progesterone Status

Figure 11 is the bar chart displaying the results. The term progesterone status refers to the level of the hormone progesterone in the body, typically about a woman's menstrual cycle and reproductive health. At the same time, Progesterone receptor (PR) status refers to whether breast cancer cells have progesterone receptors on the surface. The reason this information is important is because the presence of progesterone receptors on a breast cancer cell could indicate that the Cancer is hormone receptor-positive, which simply means that it may be responsive to hormone therapy.

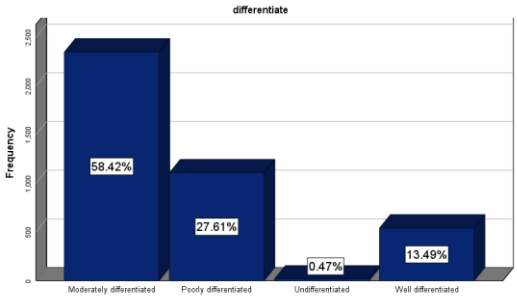

Figure 12: Bar chart of Differentiate

The result presented in Figure 12 shows that 58.4% of the sampled population has moderate differentiation - their cancer cells have a moderate level of abnormal growth and appearance. 27.6% of the population have poorly differentiated Cancer, which

suggests a higher degree of abnormal growth and appearance. 5% of the population have undifferentiated Cancer, which indicates that the cancer cells have not developed into specific types of cells and may indicate a more aggressive form of the disease. 13.5% of the population have well-differentiated Cancer, which is less aggressive as the cells have developed into mature, normal cells.

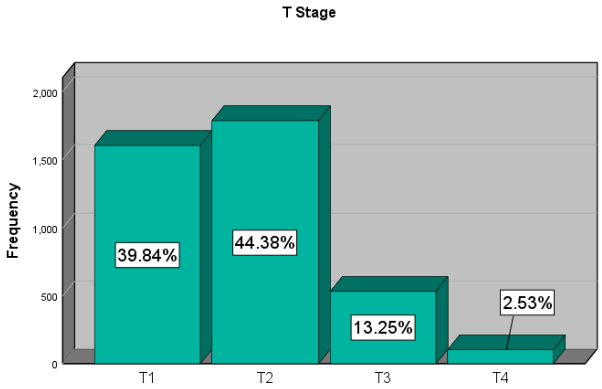

Figure 13: Bar chart of T Stage

Figure 13 shows that most % of the sampled population, which is 44.38%, have T2 stage tumours, 39.84% have T1 stage tumours, 13.25% have T3 stage tumours, and only 2.53% have T4 stage tumours. The T stage of breast cancer simply means the size and extent of the primary tumour. The results suggested that the sampled population had a higher proportion of intermediate-sized tumours.

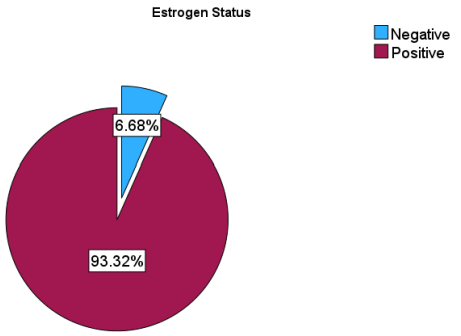

Figure 14: Pie chart of Estrogen Status

Figure 14 shows the number and percentages of female breast cancer patients by Estrogen Status. 6.7% of the sampled population have Negative Estrogen, and 93.3% have Positive Estrogen. The status can be either positive or negative. Estrogen-positive means cancer cells that are ER-positive may need Estrogen to grow. At the same time, Estrogen negative means a group of tumors with poor prognosis and fewer cancer prevention and treatment strategies compared to ER-positive tumour.

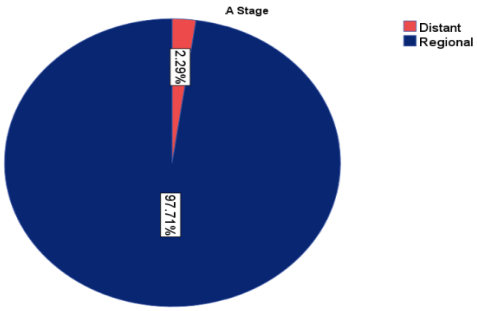

Figure 15: Pie chart of A Stage

The Stage classification in Figure 15 indicates the spread of the Cancer within the body. The term "Regional A-Stage" indicates that Cancer has spread from the initial site, which is the breast, to adjacent structures or lymph nodes. On the other hand, "Distant A-Stage" denotes that the Cancer has spread to remote parts of the body, such as the lungs, liver, or bones. The higher percentage of patients with Regional A-Stage (97.7%) suggests that most of the sampled population has a limited spread of their Cancer. In comparison, a smaller portion (2.3%) have a more advanced stage, with Cancer spread to distant parts of the body.

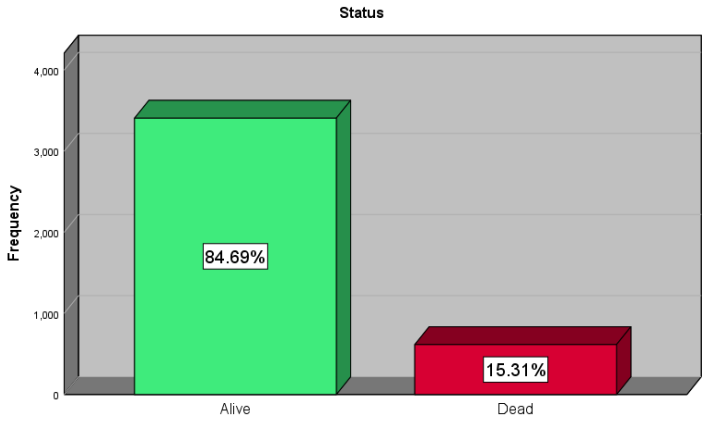

Figure 16: Bar chart of Status

Figure 16 indicates that 84.7% of the sampled population of female breast cancer patients are Alive, and 15.3% are Dead. In this context, the status "alive or dead" refers to the survival of a patient with breast cancer.

6. Conclusion

The research on breast cancer and its impact on ethnic minority women has highlighted a significant disparity in breast cancer incidence and outcomes between ethnic minority women and White women. This disparity is observed both globally and within the United States, where the literature suggests that ethnic minority women are at greater risk of developing more aggressive breast cancers and have lower survival rates compared to White women. The reasons for this disparity are multi-factorial and include a lack of access to healthcare, lack of medical coverage, barriers to early detection and screening, and unequal access to cancer treatments. Disparities in breast cancer incidence and outcomes between different racial and ethnic groups is a critical public health issue that requires continued research and action to reduce disparities and improve outcomes for all women. It is believed that women who have insurance coverage are more likely to receive timely cancer screening, diagnosis, and treatment compared to those who do not. Uninsured or underinsured women may face significant financial barriers to accessing appropriate cancer care. It is a widely held view that many factors can impact the treatment and outcome of female breast cancer patients in the United States. Women need to have access to timely, appropriate, and high-quality cancer care, regardless of their socioeconomic status, age, race or ethnicity, cancer subtype, or insurance status.

6.1. Errors and Limitations

It is crucial to consider any limitations in a study to ensure its validity and reliability are properly maintained. The researcher must acknowledge the limitations to provide a balanced view of the study outcomes and the potential limitations of generalizing the findings to other populations or contexts. In this research, the researcher faced the following limitations:

- Selection Bias: The study's sample size was based on data obtained from the National Cancer Institute's SEER Program, which may not accurately represent the entire population of female patients with breast cancer in the United States.
- Data Quality: The quality of the data used in the study depends on the accuracy and completeness of the information recorded in the SEER Program. This could impact the validity and reliability of the study results.
- Time Limit: The study only looked at patients diagnosed between 2006 and 2010, which may not reflect current trends or advancements in the diagnosis and treatment of breast cancer.
- Exclusion Criteria: The exclusion criteria used in the study, such as the exclusion of patients with unknown tumour size or survival time of less than one month, may impact the generalizability of the results to other populations.

Therefore, the researcher needs to acknowledge and discuss these limitations in the study to provide a thorough and transparent research analysis.

6.2. Recommendations for further study

The scientific evidence provided by the reviewed studies shed light on the importance of exploring the drivers of these disparities, particularly their impact on the experience and outcome of the disease in different ethnic groups. Despite the advancement in early detection of breast cancer and the potential to reduce the incidence rate, there remains a need to address the gaps in the literature and improve our understanding of the drivers of the disparities. This includes promoting breast cancer prevention, improving access to high-quality care and treatments, reducing barriers to early detection, and improving the health outcomes of ethnic minority women. Considering this, we must continue to conduct research and raise awareness of the disparities faced by ethnic minority women with breast cancer. This will require a concerted effort from the medical and scientific community, advocacy organizations, and community stakeholders to work together to address these disparities and improve health outcomes for all women.

Acknowledgment: The support of my co-author is highly appreciated.

Data Availability Statement: This study uses online benchmark data to conduct the research. This is a fresh study done by the authors.

Funding Statement: No funding has been obtained to help prepare this manuscript and research work.

Conflicts of Interest Statement: No conflicts of interest have been declared by the author(s). This is the authors' fresh work. Citations and references are mentioned as per the used information.

Ethics and Consent Statement: The consent was obtained from the colleges during data collection, and ethical approval and participant consent were received.

References

1. A. D. Arndt, J. B. Ford, B. J. Babin, and V. Luong, "Collecting samples from online services: How to use screeners to improve data quality," Int. J. Res. Mark., vol. 39, no. 1, pp. 117–133, 2022.
2. M. Arnold et al., "Current and future burden of breast cancer: Global statistics for 2020 and 2040," Breast, vol. 66, pp. 15–23, 2022.
3. O. A. Babatunde et al., "Social determinants of racial disparities in breast cancer mortality among Black and White women," J. Racial Ethn. Health Disparities, vol. 8, no. 1, pp. 147–156, 2021.
4. J. Baird, G. Yogeswaran, G. Oni, and E. E. Wilson, "What can be done to encourage women from Black, Asian and minority ethnic backgrounds to attend breast screening? A qualitative synthesis of barriers and facilitators," Public Health, vol. 190, pp. 152–159, 2021.
5. C. H. Barrios, "Global challenges in breast cancer detection and treatment," Breast, vol. 62, pp. S3–S6, 2022.
6. K. L. Britt, J. Cuzick, and K.-A. Phillips, "Key steps for effective breast cancer prevention," Nat. Rev. Cancer, vol. 20, no. 8, pp. 417–436, 2020.
7. C. M. Brown et al., "Evaluation of access to care issues in patients with breast cancer," J. Med. Econ., vol. 24, no. 1, pp. 38–45, 2021.
8. M. Cao, H. Li, D. Sun, and W. Chen, "Cancer burden of major cancers in China: A need for sustainable actions," Cancer Commun. (Lond.), vol. 40, no. 5, pp. 205–210, 2020.
9. M. Castaldi, A. Smiley, K. Kechejian, J. Butler, and R. Latifi, "Disparate access to breast cancer screening and treatment," BMC Womens. Health, vol. 22, no. 1, p. 249, 2022.
10. T. D. Ellington, S. J. Henley, R. J. Wilson, J. W. Miller, M. Wu, and L. C. Richardson, "Trends in breast cancer mortality by race/ethnicity, age, and US census region, United States─1999-2020," Cancer, vol. 129, no. 1, pp. 32–38, 2023.
11. D. Zodinpuii et al., "Breast cancer is significantly associated with cancers in the first- and second-degree relatives in ethnic Mizo-Mongoloid population, northeast India," Natl. J. Community Med., vol. 13, no. 09, pp. 606–611, 2022.
12. T. Gathani, G. Reeves, J. Broggio, and I. Barnes, "Ethnicity and the tumour characteristics of invasive breast cancer in over 116,500 women in England," Br. J. Cancer, vol. 125, no. 4, pp. 611–617, 2021.

13. A. Gebremariam et al., “Factors associated with late-stage diagnosis of breast cancer among women in Addis Ababa, Ethiopia,” Breast Cancer Res. Treat., vol. 185, no. 1, pp. 117–124, 2021.
14. A. N. Giaquinto, K. D. Miller, K. Y. Tossas, R. A. Winn, A. Jemal, and R. L. Siegel, “Cancer statistics for African American/Black people 2022,” CA Cancer J. Clin., vol. 72, no. 3, pp. 202–229, 2022.
15. A. N. Giaquinto et al., “Breast cancer statistics, 2022,” CA Cancer J. Clin., vol. 72, no. 6, pp. 524–541, 2022.
16. R. K. Goyal, H. Chen, S. M. Abughosh, H. M. Holmes, S. D. Candrilli, and M. L. Johnson, “Overall survival associated with CDK4/6 inhibitors in patients with HR+/HER2– metastatic breast cancer in the United States: A SEER-Medicare population-based study,” Cancer, vol. 129, no. 7, pp. 1051–1063, 2023.
17. K. A. Hirko et al., “The impact of race and ethnicity in breast cancer—disparities and implications for precision oncology,” BMC Med., vol. 20, no. 1, 2022.
18. IEEE DataPort,” SEER Breast Cancer Data” IEEE DataPort, 2023. https://ieee-dataport.org/open-access/seer-breast-cancer-data, [Accessed: 27-July-2023].
19. I. Jatoi, H. Sung, and A. Jemal, “The emergence of the racial disparity in U.s. breast-cancer mortality,” N. Engl. J. Med., vol. 386, no. 25, pp. 2349–2352, 2022.
20. P. Zhong, B. Yang, F. Pan, and F. Hu, “Temporal trends in Black-White disparities in cancer surgery and cancer-specific survival in the United States between 2007 and 2015,” Cancer Med., vol. 12, no. 3, pp. 3509–3519, 2023.
21. A. Johansson et al., “Characterization of benign breast diseases and association with age, hormonal factors, and family history of Breast Cancer among women in Sweden,” JAMA Netw. Open, vol. 4, no. 6, p. e2114716, 2021.
22. K. K. Lee et al., “Ethnic disparities in mortality and group-specific risk factors in the UK Biobank,” PLOS Glob. Public Health, vol. 3, no. 2, p. e0001560, 2023.
23. S. Leonard-Murali, S. D. Nathanson, K. Springer, P. Baker, and L. Susick, “Early breast cancer survival of black and white American women with equal diagnostic and therapeutic management,” Eur. J. Surg. Oncol., vol. 49, no. 3, pp. 583–588, 2023.
24. A. Mandal, “Cancer history,” News-medical.net, 02-Dec-2009. [Online]. Available: https://www.news-medical.net/health/Cancer-History.aspx. [Accessed: 27-July-2023].
25. H. K. Matthews, C. Bertoli, and R. A. M. de Bruin, “Cell cycle control in cancer,” Nat. Rev. Mol. Cell Biol., vol. 23, no. 1, pp. 74–88, 2022.
26. K. R. Menikdiwela, C. Kahathuduwa, M. L. Bolner, R. L. Rahman, and N. Moustaid-Moussa, “Association between obesity, race or ethnicity, and Luminal subtypes of breast cancer,” Biomedicines, vol. 10, no. 11, p. 2931, 2022.
27. NHS, “Breast cancer in women,” nhs.uk. [Online]. Available: https://www.nhs.uk/conditions/breast-cancer/. [Accessed: 27-July-2023].
28. R. Nussinov, C.-J. Tsai, and H. Jang, “How can same-gene mutations promote both cancer and developmental disorders?,” Sci. Adv., vol. 8, no. 2, p. eabm2059, 2022.
29. A. L. Parui and K. Bose, “Cancer biology and its treatment modalities: A brief historical perspective. Unravelling Cancer Signaling Pathways: A Multidisciplinary Approach,” pp. 1–11, 2019.
30. W. Peng, R. Wu, W. Dai, and N. Yu, “Identifying cancer driver genes based on multi-view heterogeneous graph convolutional network and self-attention mechanism,” BMC Bioinformatics, vol. 24, no. 1, p. 16, 2023.
31. R. Rodrigues, D. Duarte, and N. Vale, “Drug repurposing in cancer therapy: Influence of patient’s genetic background in breast cancer treatment,” Int. J. Mol. Sci., vol. 23, no. 8, p. 4280, 2022.
32. I. Linck Rosenhaim, S. Mieruch-Schnülle, and R. Schlitzer, “Data preparation for the development of a user-friendly, free, online, and interactive platform for the visualization and analysis of interdisciplinary data,” 2023, Press.
33. M. Saunders, P. Lewis, and A. Thornhill, Research Methods for Business Students. Pearson, India, 2019.
34. H. Sung et al., “Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries,” CA Cancer J. Clin., vol. 71, no. 3, pp. 209–249, 2021.
35. C. G. Yedjou et al., “Health and racial disparity in breast cancer,” Adv. Exp. Med. Biol., vol. 1152, pp. 31–49, 2019.
36. H. Teimouri and A. B. Kolomeisky, “Can we understand the mechanisms of tumor formation by analyzing dynamics of cancer initiation?,” EPL, vol. 137, no. 2, p. 27001, 2022.
37. S. M. Walsh, E. C. Zabor, J. Flynn, M. Stempel, M. Morrow, and M. L. Gemignani, “Breast cancer in young black women,” Br. J. Surg., vol. 107, no. 6, pp. 677–686, 2020.
38. S. E. Whang, Y. Roh, H. Song, and J.-G. Lee, “Data collection and quality challenges in deep learning: a data-centric AI perspective,” VLDB J., vol. 32, no. 4, pp. 791–813, 2023.
39. C. Xia et al., “Cancer statistics in China and United States, 2022: profiles, trends, and determinants: Profiles, trends, and determinants,” Chin. Med. J. (Engl.), vol. 135, no. 5, pp. 584–590, 2022.