Review Article

A comprehensive review on Breast Cancer

Sudhir[1], Reetika Gupta[2]*, Babita[2], Simran Singh Rathore[2], Vartika Lohani[2],Amandeep Singh[3]

[1] Student, School of Pharmaceutical Sciences, Jigyasa University, Dehradun, Uttarakhand, India
[2]Assistant Professor, School of Pharmaceutical Sciences Jigyasa University, Dehradun, Uttarakhand, India
[3]Professor, School of Pharmaceutical Sciences Jigyasa University, Dehradun, Uttarakhand, India

Received: 20-12-2025 / Revised: 25-12-2025 / Accepted: 04-02-2026

Abstract

Breast cancer has been recognized since ancient times, with early descriptions found in Egyptian and Greek medical texts. From rudimentary surgical techniques to sophisticated diagnostic and treatment methods, knowledge of this illness has developed over centuries. Due to a variety of factors, including age, hormonal exposure, genetics, and lifestyle, breast cancer is still the most common cancer among women worldwide. Surgery, radiation, chemotherapy, hormone therapy, and targeted biological agents—which are chosen based on the type and stage of the tumour—are all part of modern treatment. Results are significantly improved by early detection. Significant differences still exist between nations with varying socioeconomic statuses despite global advancements. Reducing mortality and guaranteeing fair access to care require ongoing research, better health systems, and awareness campaigns. Although breast cancer is still a significant public health concern, survival rates are improving with prompt and thorough treatment. Early references to breast cancer can be found in Egyptian and Greek medical texts, indicating that the disease is widespread and has been known since antiquity. From simple surgical excisions to sophisticated, multimodality care involving surgery, radiotherapy, chemotherapy, hormone therapy, and targeted biological agents, treatment has changed over centuries. Despite these developments, a variety of risk factors, including age, hormonal exposure, genetics, and lifestyle, continue to make breast cancer the most common cancer among women worldwide. An estimated 2.3 million new cases and 670,000 deaths were reported globally in 2022. Survival rates are greatly increased by early detection through screening and prompt, individualised treatment, but significant differences still exist between countries. Strong health systems in high-socioeconomic nations reduce mortality, while low- and middle-income areas are disproportionately affected by delayed diagnosis and restricted access to care. The urgent need for scalable public health interventions, improved referral systems, and fair access to high-quality cancer services is highlighted by the global mortality gap. Millions of lives could be saved by initiatives to improve treatment pathways and increase early diagnosis under the World Health Organization's Global Breast Cancer Initiative. Without such action, estimates point to a 68% increase in deaths and a nearly 38% increase in annual cases of breast cancer by 2050, with low-HDI countries being disproportionately affected. In conclusion, breast cancer continues to be a significant global public health concern despite advancements in treatment and survival; lowering mortality will necessitate ongoing funding, raising awareness, and bolstering the health system.

Keywords- Breast cancer, Global health challenge, Diagnosis, Treatment, Survival, Research funding.

Introduction

Cancer is a disease in which some body cells proliferate uncontrollably and spread to other body parts. Because the human body is composed of billions of cells, malignant growth can start anywhere. In order to create the necessary cells that the body requires, human cells regularly proliferate and divide (a process known as cell division), when cells age or sustain damage.[1-3]

Breast cancer is a condition where abnormal cells in the breast proliferate and develop into cancer. The growths have the potential to spread throughout the body and become fatal if left untreated. Within the milk ducts and milk lobules that transport the milk, breast cancer cells start to proliferate. The oldest buildings (sites) can be identified early on and are not hazardous. Adjacent sinus tissue may be invaded by cancer cells. This leads to the development of a tumour that thickens or forms a nodule. Malignant invasive tumours have the potential to metastasis, or spread to nearby lymph nodes or other organs. Metastasis is lethal and dangerous. The individual, the kind of cancer, and its severity all affect the course of treatment. [5-8] Prescription drugs, radiation therapy, and medical procedures are all part of this treatment.

Reetika Gupta
Assistant Professor, School of Pharmaceutical Sciences Jigyasa University, Dehradun, Uttarakhand, India

Breast cancer is an unchecked growth of epithelial cells that starts in the breast's ducts or lobules. Ductal carcinoma in situ (DCIS) and lobular carcinoma in situ (LCIS), two breast diseases that affect the surrounding stroma (essential obstructive breast disease), are examples of malignant breast tumours that grow early and painlessly.A tumour that thickens or develops into a nodule results from this. It is possible for malignant invasive tumours to metastasise, or spread to adjacent lymph nodes or other organs. Metastasis is dangerous and deadly. The treatment plan is influenced by the patient, the type of cancer, and its severity.[9] This treatment includes medical procedures, radiation therapy, and prescription medications. Carbone et al. (1993) defined breast cancer as an unchecked proliferation of epithelial cells that begins in the ducts or lobules of the breast. Malignant breast tumours that grow early and painlessly include ductal carcinoma in situ (DCIS) and lobular carcinoma in situ (LCIS), two breast diseases that affect the surrounding stroma (essential obstructive breast disease).[3] Medical procedures, chemotherapy, radiation therapy (RT), endocrine therapy, and prescription medications are all used to treat breast cancers. such as immunotherapy and therapy regimens. For non-metastatic breast cancer, cooperation between various specialists is necessary, medical procedure-based treatment is the norm, and neoadjuvant chemotherapy-based chemotherapy lowers the volume of breast cancer, permits the preservation of pubic bone, and lessens the requirement for axillary lymph node testing (ALND). Only a small percentage of patients with metastatic breast disease receive palliative medical treatment; basic

treatment is still the recommended course of action. It is necessary for various experts to work together.[2]

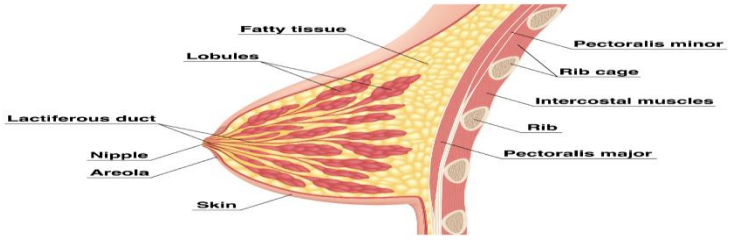

Fig.1: Anatomy of Breast [41]

Key facts

Breast cancer caused 1670 000 deaths globally in 2022.

Roughly half of all breast cancers occur in women with no specific risk factors other than sex and age.[14]

Breast cancer was the most common cancer in women in 157 countries out of 185 in 2022. Breast cancer occurs in every country in the world.

Approximately 0.5-1% of breast cancers occur in men.[11]

History

Malignant growth of the bosom has long been a significant concern for humans. For example, cases of breast cancer are shown in the Edwin Smith Careful Papyrus Trusted Source. This medical text dates back to between 3,000 and 2,500 Ò.P.E.Votive offerings were made to the lord of medicine in ancient Greece by people dressed like bosoms. Hippocrates also depicted the stages of breast cancer development in the middle of the 400s BCE. President Gerald Passage's wife, Elizabeth Anne "Betty" Portage, served as First Woman from 1974 to 1977.[15] She was well-known for promoting awareness of breast cancerous growth and for being a fervent supporter of the Equivalent Freedoms Revision. The female breast has long been associated with beauty, fertility, and femininity. In any event, it has put medical professionals to the test since the beginning of time. When the blade was applied to the bosom during a medical procedure that involved wearing the pants to treat a disease, it undoubtedly caused deformation.[4] The history of bosom disease is a confusing maze of attempts to understand the cunning concept of this chemically responsive malignant growth and the desire of medical professionals to eradicate it through physical removal (medical procedure), cell obliteration (chemo-radiotherapy), or targeted treatment of cell receptors (bio modulation).[3] Finding the devices to enable early determination is also a serious investigation adventure. The following sections tell the story of medical procedure's development from fatalistic decisions to minimal harm, and how it has been mastered for more than two centuries. The story is interwoven with the pathobiological premise of bosom malignant growth, which transformed surgical practice from crude to creative. Breast cancer has existed since ancient times. Almost all of written history contains references to it. Due to the apparent side effects, especially at Haber wagon, doctors from Carly Uma's have documented advancements to cancers.[18] Because of this, we at Alt, like other inside divers, frequently have breast protuberances that appear to be cancers or thermoclines. Because of this, we at Alt, like other inside divers, frequently have breast protuberances that appear to be cancers or thermoclines. Despite this, there was no humiliation that suggested recognition, and the discovery was intriguing. It was rare to find malignant growths on the bosom in books and clinical diaries. A new phenomenon that dates back about thirty or forty years is the including of more women and the successful execution of the infection out of the dark. In the 1990s, the image of the pink strip on the bosom, which represents malignant growth, inspired a change against this disease.

CAUSES

Young women under the age of 19 are less likely to develop breast cancer.

Women over 35 who experience menopause are more likely to develop breast cancer due to waste products that aren't eliminated from their bodies. It's likely that someone will experience their most memorable time before turning twelve.[6]

Women who wait until they are thirty years old to become pregnant also run the risk of developing breast cancer.[6]

Menstruation continues until a woman reaches the age of 55. Her risk of developing breast cancer is high. There is a chance of bosom disease if a young woman's menstrual cycle is disrupted and delayed for several months.

Some people take medication to improve their bodies. Similarly, prophylactic and contraceptive pills can cause bosom disease.[16]

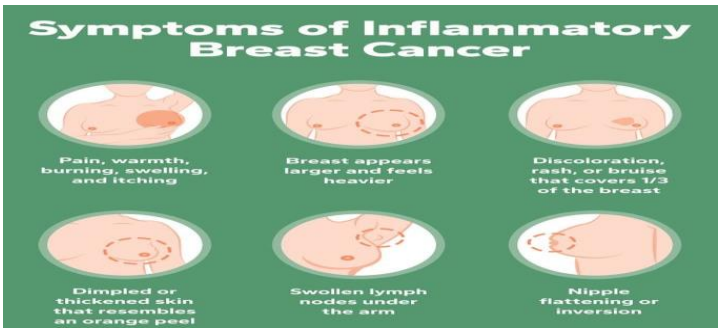

Fig.2?: Symptoms of Breast Cancer[42]

Who is at risk?

Being a woman is the largest risk factor for breast cancer. Men are affected by breast cancer in 0.5–1% of cases, whereas women are affected in approximately 99% of cases. The management guidelines for men with breast cancer are the same as those for women.

Age, obesity, hazardous alcohol use, radiation exposure history, family history of breast cancer, reproductive history (including the age at which menstruation started and the age of the first

pregnancy), tobacco use, postmenopausal hormone therapy, and other factors all raise the risk of breast cancer. Approximately 50% of breast cancers occur in women who have no discernible risk factors for the disease other than their age (over 40) and gender (female). Although the majority of women who are diagnosed with breast cancer do not have a known family history of the disease, having a family history of breast cancer increases the risk of developing breast cancer. A woman is not always at lower risk just because her family history is unknown.

The most common inherited high penetrance gene mutations that significantly raise the risk of breast cancer are those in the BRCA1, BRCA2, and PALB-2 genes.Women who have mutations in these key genes may think about risk-reduction measures like chemoprevention or surgically removing both breasts.

SCOPES:-In 2022, 670,000 people died worldwide and 2.3 million women were diagnosed with breast cancer.

Every country in the world has breast cancer, which can develop in women at any point after puberty but at an increasing rate as they age.

Global assessments reveal startling differences in the problem of breast cancer growth according to human circumstances. For example, in nations with an exceptionally high Human Improvement Record, 1 of every 12 ladies will be determined to have bosom malignant growth in the course of their life and 1 in 71 ladies pass on from it.[20]

Conversely, in nations with a low HDI; while just 1 out of 27 ladies is determined to have bosom disease in the course of their life, 1 out of 48 ladies will pass on from it.[17-19]

TREATMENT:-The course of treatment for breast cancer is determined by the cancer's subtype and the extent to which it has spread to lymph nodes (stages II or III) or other body parts (stage IV).

To reduce the likelihood that the cancer will return (recur), doctors combine different treatments. These consist of:-

Radiation therapy to lower the risk of recurrence in the breast and surrounding tissues.

hormone therapies,Chemotherapy, or targeted biological therapies to eradicate cancer cells and stop their spread.

surgery to remove the breast tumour.Breast cancer treatments that are initiated early and completed are more effective and better tolerated.

Surgery can remove the entire breast (mastectomy) or just the cancerous tissue (lumpectomy). In order to determine whether the cancer can spread, surgery may also remove lymph nodes. Radiation therapy reduces the likelihood of cancer reoccurring on the chest wall and treats microscopic cancers that are still present in the breast tumour and/or lymph nodes.[6]

Although they are not always painful, advanced canoers have the potential to erode through the skin and result in open sores, or ulcerations. Women who have non-healing breast wounds should see a doctor so that a biopsy can be done.

Medicines to treat breast cancers are selected based on the biological properties of the cancer as determined by special tests (tumour marker determination). The vast majority of medications used to treat breast cancer are already listed on the WHO Essential Medicines List(EML).

For invasive cancers, lymph nodes are removed during cancer surgery. In the past, it was believed that in order to stop cancer from spreading, the lymph node bed beneath the arm had to be completely removed (complete axillary dissection). Nowadays, "sentinel node biopsy," a smaller lymph node procedure with fewer complications, is recommended.

Based on the biological subtyping of the cancers, medical treatments for breast cancers can be administered either before ("neoadjuvant") or after ("adjuvant") surgery. Some subtypes of breast cancer, such as triple negative (those lacking the HER-2, progesterone, or estrogenic receptors), are more aggressive than others. Tamoxifen and aromatase inhibitors are examples of endocrine (hormone) therapies that are likely to be effective for cancers that express the estrogenic receptor (ER) and/or progesterone receptor (PR). These medications, which are taken orally for five to ten years, cut the risk of recurrence of these "hormone-positive cancers" in half. Although they are usually well tolerated, endocrine therapies can cause menopausal symptoms.Chemotherapy is required for "hormone receptor negative" cancers, which do not express ER or PR, unless they are extremely small. Today's chemotherapy regimens are highly effective at lowering the risk of cancer recurrence or spread and are generally gives as outpatient's therapy. Chemotherapy for breast cancer generally does not required hospitals admission in the absence of complications.

In the treatment of breast cancer, radiotherapy is crucial. Radiation can save a woman from needing a mastectomy when her breast cancer is in its early stages. Even after a mastectomy, radiotherapy can lower the risk of cancer recurrence in later-stage cancers. In certain cases, radiation therapy may lower the chance of dying from advanced stages.[11]

The entire course of treatment determines how well breast cancer treatments work. Partial therapy is less likely to result in targeted biological agents like trastuzumab can be used to treat breast cancers that independently overexpress a molecule known as the HER-2/neu oncogene (HER-2 positive).[9]In order to effectively kill cancer cells, targeted biological therapies are administered in conjunction with chemotherapy.

Fig.3: Breast Cancer Treatment[43]

STAGES OF BREAST CANCER:-

Stage I

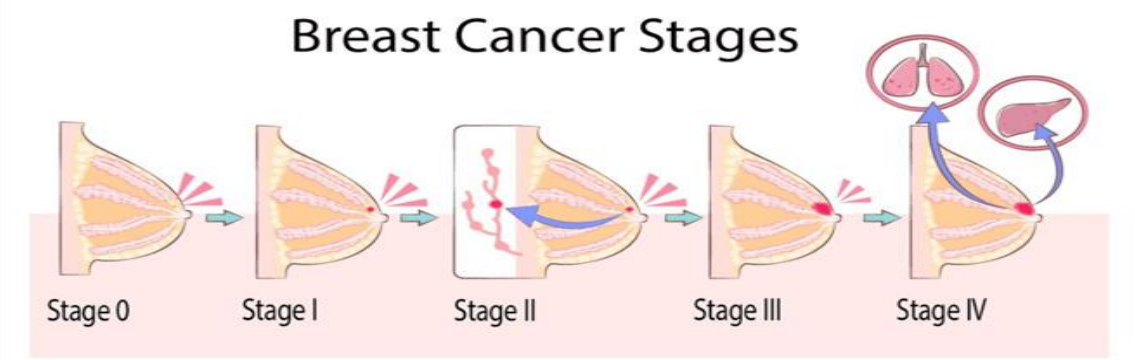

Fig 4:- Stages of Breast Cancer[44]

Stage IA: The tumor is no larger than two centimetres and has not spread outside the breast.

Stage IB: The lymph nodes contain tiny clusters of cancer cells that are larger than 0.2 mm but not larger than 2 mm. These cells wither the tumor is two centimeters or less, and no breast tumor is discovered.

Stage II

Based on the tumour size, lymph node involvement, and whether the cancer has spread to other body parts, the stages of breast cancer are categorized. The American Joint Committee on Cancer (AJCC) TNM system, which stands for tumour size, node involvement, and metastasis, is the staging method that is frequently employed.

The stages are as follows:

Stage IIA: One of the following is true:

One to three axillary lymph nodes or lymph nodes near the breastbone have cancer, but the breast itself is tumor-free. The tumour is two centimetres or smaller; it has spread to one to three axillary lymph nodes; it has spread to lymph nodes near the breastbone; or it is larger than two centimetres but not more than five centimetres and has not spread to the lymph nodes.

Stage IIB: One of the following is true:

Here are tiny clusters of cancer cells (0.2 mm to 2 mm) in the lymph nodes, and the tumor is larger than 2 cm but not more than 5 cm.

The tumor has spread to one to three axillary lymph nodes or to lymph nodes close to the breastbone, and it is more than two centimeters but not more than five; or although the tumor is more than five centimeters in size, the lymph nodes have not been affected.

Stage III

Stage IIIA: One of the following is true:

When cancer is found in four to nine axillary lymph nodes or in lymph nodes near the breastbone, there is either no breast tumour or a tumour of any size; the lymph nodes contain small clusters of cancer cells (0.2 mm to 2 mm) and the tumour is larger than five centimetres; or the tumour is larger than five centimetres and has spread to one to three axillary lymph nodes or to lymph nodes near the breastbone.[15]

Stage IIIB:

Inflammatory breast cancer has been identified, the tumor has spread to the chest wall, or it has resulted in breast swelling or ulceration. It might have reached lymph nodes close to the breastbone or as many as nine axillary lymph nodes.[14]

Stage IIIC:

The cancer has spread to lymph nodes above or below the collarbone, to axillary lymph nodes, or to lymph nodes close to the breastbone. It is detected in ten or more axillary lymph nodes.

Stage IV

Stage IVA: The cancer has progressed to other body parts, including the brain, liver, lungs, and bones, in addition to the breast and surrounding lymph nodes. Another name for this is metastatic breast cancer determining the best course of treatment and forecasting the disease's likely progression require an understanding of the stages of breast cancer.[15]

Anticancer Drugs

Anticancer drugs, sometimes known as chemotherapeutic agents or antineoplastic agents, are pharmaceuticals used to stop, manage, or eradicate cancer cells. They target rapidly dividing cancerous cells more than healthy cells, interfering with cell growth, division, or survival.[17]

Classification of Anticancer Drugs

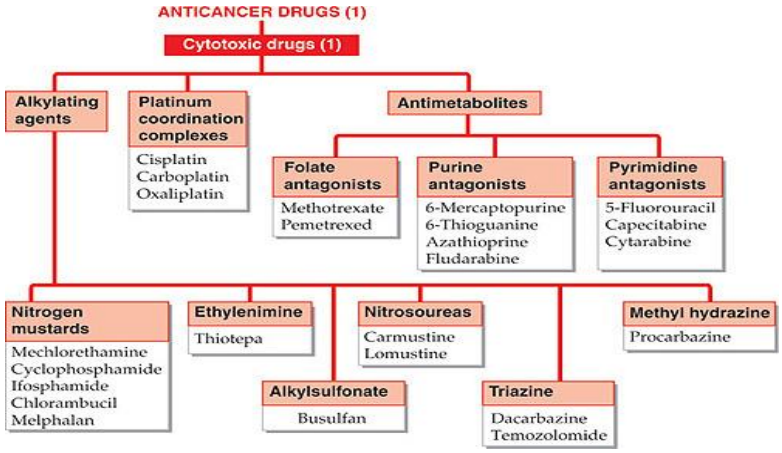

Fig. 5:–Anticancer Drugs

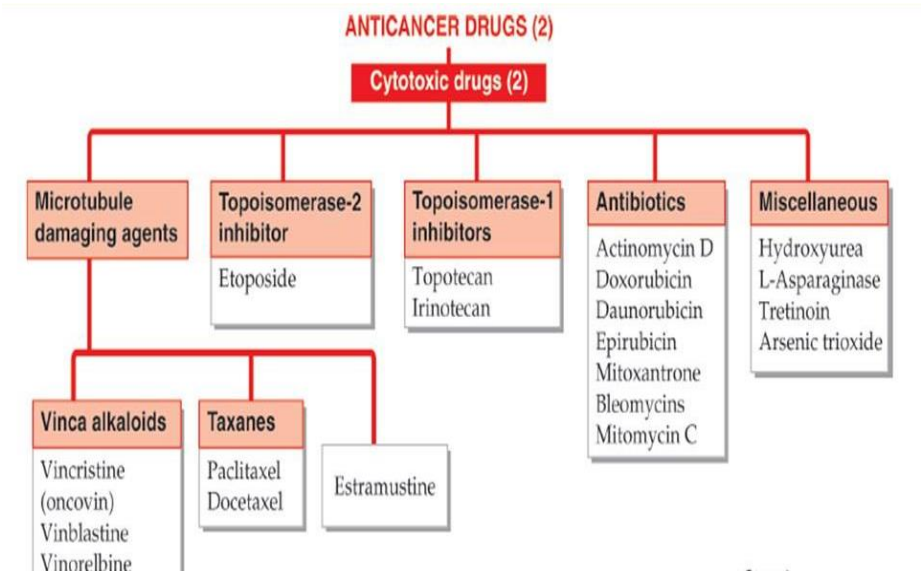

Fig. 6-: Anticancer Drugs

Anti metabolites

One important class of anticancer (chemotherapy) drugs that disrupt DNA and RNA synthesis is called antimetabolite drugs. By blocking vital metabolic pathways, they mimic normal cellular molecules like folic acid, purines, or pyrimidines and stop cancer cells from proliferating and dividing.[20]

Eg- Methotrexate, Pemetrexed, etc.

Uses of Anti metabolites

Inflammatory and Autoimmune Disorders
First-line DMARD for rheumatoid arthritis
Moderate to severe psoriasis
Arthritis psoriatic
Idiopathic arthritis in children.[18]
Anti cancer agents like-acute lymphoblastic leukaemia
Also use to treat Psoriasis (moderate to severe)
Some time use to treat Crohn's disease
This medication used in Breast cancer treatment.[20]

Global impact

Between the 1980s and 2020, high-income countries saw a 40% decrease in age-standardized breast cancer mortality (1). Countries that have been successful in lowering the death rate from breast cancer have been able to do so at a rate of two to four percent annually.

In order to provide the proven effective treatments, the strategies for improving the outcomes of breast cancer rely on the fundamental strengthening of the health system. These are also crucial for managing non-malignant noncommunicable diseases (NCDs) and other cancers.[19]For instance, having trustworthy routes for referrals from primary care offices to district hospitals and specialized cancer centres. The management of cervical, lung, colorectal, and prostate cancers all require the establishment of trustworthy referral pathways from primary care offices to secondary hospitals and specialized cancer centres. In light of this, breast cancer is referred to as an index disease, through which management strategies for other cancers can be developed.[10]

Conclusion

In conclusion, despite centuries of advancements in knowledge and treatment, breast cancer continues to pose a significant threat to global health. The burden of disease is not evenly distributed, despite the fact that recent developments in radiation, chemotherapy, surgery, and targeted therapies have greatly improved outcomes. In areas with poor access to treatment, late-stage diagnosis, and inadequate healthcare infrastructure, mortality is still unacceptably high. A clear road map to address these disparities is provided by initiatives like the WHO's Global Breast Cancer Initiative (GBCI), which places a high priority on early detection, prompt diagnosis, and comprehensive management. It is possible to significantly lower the global death rate by bolstering health systems, raising awareness, and making sure that each patient finishes their entire course of treatment. Millions of lives could be saved if such concerted efforts are carried out and maintained. In the end, overcoming breast cancer will require not only scientific advancement but also social commitment, political will, and universal access to healthcare. Ultimately, reducing the global impact of breast cancer requires a multifaceted approach that extends beyond clinical innovation. Strengthening community engagement, investing in public health education, and fostering culturally sensitive screening programs are critical for ensuring that early detection becomes a universal reality rather than a privilege. Furthermore, in order to assist low- and middle-income nations in their efforts to enhance diagnostic capabilities, increase treatment accessibility, and train healthcare professionals, international cooperation and consistent funding are crucial.Reducing the stigma associated with the illness, encouraging fair research participation, and empowering patients through advocacy can all aid in closing current gaps. The momentum created by countries incorporating evidence-based practices into their health policies has the potential to change breast cancer outcomes globally. The goal of lowering avoidable deaths and improving the quality of life for everyone impacted by breast cancer becomes not only possible but also inevitable with unwavering dedication and international solidarity.

References

1. Tey T., Appleby P., Barnes I., Reeves G. The Endogenous Hormones and Breast Cancer Collaborative Group Endogenous Sex Hormones and Breast Cancer in Postmenopausal Women: Reanalysis of Nine Prospective Studies. J. Natl. Cancer Inst. 2002;94:606–616.
2. Giordano S.H. Breast cancer in men. N. Engl. J. Med. 2018;378:2311–2320.
3. Benz C.C. Impact of aging on the biology of breast cancer. Crit. Rev. Oncol. 2008;66:65–74.
4. Siegel R., Ma J., Zou Z., Jemal A. Cancer statistics, 2014. CA Cancer J. Clin. 2014;64:9–29.

5. McGuire A., Brown J.A.L., Malone C., McLaughlin R., Kerin M.J. Effects of Age on the Detection and Management of Breast Cancer. Cancers. 2015;7:908–929.
6. .Stat Bite: Lifetime Probability among Females of Dying of Cancer. JNCI J. Natl. Cancer Inst. 2004;96:1311–1321.
7. Collaborative Group on Hormonal Factors in Breast Cancer Familial breast cancer: Collaborative reanalysis of individual data from 52 epidemiological studies including 58,209 women with breast cancer and 101,986 women without the disease. Lancet. 2001;358:1389–1399.
8. Shiyanbola O.O., Arao R.F., Miglioretti D.L., Sprague B.L., Hampton J.M., Stout N.K., Kerlikowske K., Braithwaite D., Buist D.S., Egan K.M., et al. Emerging Trends in Family History of Breast Cancer and Associated Risk. Cancer Epidemiol. Biomark. Prev. 2017;26:1753–1760.
9. Baglia M.L., Tang M.-T.C., Malone K.E., Porter P., Li C.I. Family History and Risk of Second Primary Breast Cancer after In Situ Breast Carcinoma. Cancer Epidemiol. Biomark. Prev. 2018;27:315–320.
10. Brewer H.R., Jones M.E., Schoemaker M.J., Ashworth A., Swerdlow A.J. Family history and risk of breast cancer: An analysis accounting for family structure. Breast Cancer Res. Treat. 2017;165:193–200.
11. Wu H.C., Do C., Andrulis I.L., John E.M., Daly M.B., Buys S.S., Chung W.K., Knight J.A., Bradbury A.R., Keegan T.H.M., et al. Breast cancer family history and allele-specific DNA methylation in the legacy girls study. Epigenetics. 2018;13:240–250.
12. Elik A., Acar M., Erkul C.M., Gunduz E., Gunduz M. Relationship of Breast Cancer with Ovarian Cancer. Concise Rev. Mol. Pathol. Breast Cancer. 2015:87–202.
13. Shiovitz S., Korde L.A. Genetics of breast cancer: A topic in evolution. Ann. Oncol. 2015;26:1291–1299
14. Shahbandi A., Nguyen H.D., Jackson J.G. TP53 Mutations and Outcomes in Breast Cancer: Reading beyond the Headlines. Trends Cancer. 2020;6:98–110.
15. .Corso G., Veronesi P., Sacchini V., Galimberti V. Prognosis and outcome in CDH1-mutant lobular breast cancer. Eur. J. Cancer Prev. 2018;27:237–238..Corso G., Intra M., Trentin C., Veronesi P., Galimberti V. CDH1 germline mutations and hereditary lobular breast cancer. Fam. Cancer. 2016;15:215–219. doi: 10.1007/s10689-016-9869-5.
16. .Kechagioglou P., Papi R.M., Provatopoulou X., Kalogera E., Papadimitriou E., Grigoropoulos P., Nonni A., Zografos G., Kyriakidis D.A., Gounaris A. Tumor suppressor PTEN in breast cancer: Heterozygosity, mutations and protein expression. Anticancer. Res. 2014;34:1387–1400.
17. Chen J., Lindblom A. Germline mutation screening of the STK11/LKB1 gene in familial breast cancer with LOH on 19p. Clin. Genet. 2001;57:394–397.
18. Renwick A., The Breast Cancer Susceptibility Collaboration (UK) Thompson D., Seal S., Kelly P., Chagtai T., Ahmed M., North B., Jayatilake H., Barfoot R., et al. ATM mutations that cause ataxia-telangiectasia are breast cancer susceptibility alleles. Nat. Genet. 2006;38:873–875.
19. Rahman N., The Breast Cancer Susceptibility Collaboration (UK) Seal S., Thompson D., Kelly P., Renwick A., Elliott A., Reid S., Spanova K., Barfoot R., et al. PALB2, which encodes a BRCA2-interacting protein, is a breast cancer susceptibility gene. Nat. Genet. 2006;39:165–167.
20. Seal S., The Breast Cancer Susceptibility Collaboration (UK) Thompson D., Renwick A., Elliott A., Kelly P., Barfoot R., Chagtai T., Jayatilake H., Ahmed M., et al. Truncating mutations in the Fanconi anemia J gene BRIP1 are low-penetrance breast cancer susceptibility alleles. Nat. Genet. 2006;38:1239–1241.

Conflict of Interest: Nil
Source of support: None