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Research Article

Shifting Paradigm in the Incidence of Postmenopausal Breast Cancer in Sulaimani in 10 Years Period

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ABSTRACT

Breast cancer (BC) remains the most common malignancy among women worldwide, with postmenopausal women accounting for a substantial proportion of cases; however, data on long-term incidence trends and molecular subtype patterns in Iraqi Kurdistan remain limited. This study evaluated 10-year incidence trends of postmenopausal BC in Sulaimani, Iraq, and characterized associated demographic factors and molecular subtype distributions. A cross-sectional study was conducted using clinical records from Hiwa Cancer Hospital and Zhianawa Hospital between 2015 and 2024. Age-standardized incidence rates (ASIRs) were calculated, and temporal trends were assessed using Joinpoint regression analysis to estimate annual percent change (APC). Demographic, clinical, and molecular characteristics, including estrogen receptor, progesterone receptor, Human epidermal growth factor receptor 2 (*HER2*), and *Ki-67* based immunohistochemical subtypes (Luminal A, Luminal B, HER2-enriched, and Triple Negative), were analyzed in a representative sample of postmenopausal BC patients. The ASIR of BC increased from 119.1/100,000 in 2015 to 164.0/100,000 in 2024, reflecting a 37.8% overall rise. Joinpoint regression identified a marked increase between 2015 and 2017 (APC = +10.24%), followed by a plateau from 2017 to 2024 (APC = +0.02%). Women aged 55–64 years constituted the largest proportion of postmenopausal cases, with evidence of a shift toward younger postmenopausal age groups over time. Obesity was highly prevalent among patients. Luminal B was the predominant molecular subtype, while HER2-enrichedand triple-negative subtypes declined significantly across the study period. In conclusion, postmenopausal BC incidence in Sulaimani has increased over the past decade, with recent stabilization and a shift toward hormone receptor-positive molecular subtypes. These findings underscore the importance of strengthening early detection strategies, addressing modifiable risk factors, and optimizing subtype-guided management to improve BC outcomes in the region.

Keywords: Postmenopausal breast cancer, Incidence trend, Joinpoint regression, Molecular subtypes, Sulaimani, Iraq.

INTRODUCTION

Breast cancer (BC) is a complex, heterogeneous disease and a major global health concern.[1] It is the most prevalent malignancy among women worldwide and consistently ranks among the top two cancers for both incidence and mortality.[2,3] Despite declining mortality over the past five decades, BC remains a leading cause of death, with nearly 1 million deaths projected annually by 2040.[2] Early detection and accurate diagnosis are critical for improving outcomes, yet disparities persist: Highly developed regions demonstrate higher survival due to screening and treatment access, while less-developed areas often report over half of cases as locally advanced or metastatic at diagnosis.[4] To address this, the WHO launched the Global BC Initiative in 2021, aiming to reduce mortality by 2.5% annually and prevent 2.5 million deaths by 2040, focusing on women under 70.[4]

Postmenopausal BC, typically at age 50+, contributes substantially to the global burden, with 1.4 million cases in 2018 and age-standardized incidence rates (ASIRs) reaching 253.6/100,000 in very high-HDI countries.[3,5] Global surveillance indicates fluctuating postmenopausal BC incidence; in 2018, the global ASIR for women aged 50+ was 152.6/100,000, 1.6 times higher in very high-HDI countries.[5,6] Risk factors include modifiable elements like obesity, physical inactivity, hormone replacement therapy (HRT), and diabetes, alongside non-modifiable factors such as age at menarche, family history, and *BRCA* mutations.[7]

BC is not a single disease but a collection of molecularly distinct subtypes, classified through estrogen receptor (*ER*), progesterone receptor (*PR*), Human epidermal growth factor

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receptor 2 (*HER2*), and *Ki67* biomarkers.[1] Luminal A, the most common subtype (~76%), generally responds well to endocrine therapy, whereas *HER2*-enriched tumors (15–20%) are more aggressive. Triple-negative BC (TNBC) is the most challenging, lacking *ER*, *PR*, and *HER2* expression, with a poor prognosis even when diagnosed early.[8] Treatment decisions, including postoperative radiation, rely on tumor stage, molecular subtype, and patient age.[9] Targeted therapies, such as PARP inhibitors, are effective for TNBC with *BRCA* mutations.[8]

In the MENA region, BC incidence is rising rapidly, with the highest increases since 1990.[5-10] Mean age at diagnosis varies across countries, and subtype distributions differ, for example, Luminal A represents 70% of cases in Egypt. In Iraq, women aged 50–59 experienced an APC of +3.192%, and those 70+ saw +7.94% (2000–2019), reflecting obesity, diet, and inactivity. Late-stage diagnosis remains prevalent due to limited screening, emphasizing the need for accurate classification, early detection, and context-specific interventions to manage BC effectively.[5-10] To the best of our knowledge, this is the first study conducted in Sulaimani to evaluate 10-year postmenopausal BC incidence trends using joinpoint regression and to examine molecular subtype distribution.

LITERATURE REVIEW

Background in History

Insight into and control of BC has progressed over millennia from anatomy itself to molecules and the genome. The first reference to breast tumors was around 3500 years ago, by the ancient Egyptians who recorded their findings in texts like the Edwin Smith Surgical Papyrus. Tumors of the breast are external and palpable, so were among the first cancers ever recorded, but broader public discussion continued to be poor and stigmatized for centuries.[11]

In much of antiquity and in the Middle Ages, BC was thought to be explicable by the humoral theory. Hippocrates (ca 460 BCE), for example, suggested that tumors were caused by an "overbalance of black bile," in keeping with the idea that disease was a reflection of disordered humoral balance. He named the tumors karkinos ("crab"), that mimicked their physical appearance.[11,12] Galen (c. 200 AD) extended this idea, believing that BC also spread through the lymphatic system and was caused by an accumulation of black bile. Management was poor with diet modification, bloodletting, and herbs used as a treatment; surgery remained suboptimal and unacceptable.[11]

The discovery of the lymphatic system in the 17th century saw a major change, causing infections and cancer to be lumped together as one disease. Henri Le Dran in the mid-18th century believed that cancer involved only local progression before spreading to lymph nodes and advised early surgical excision.[11] This concept emerged in the Halstedian model of the late 19th century which viewed BC as a locoregional disease that should be eradicated by radical surgery.[12,13] In 1894, Halsted described the radical mastectomy where in addition to excising of the breast tissue, he also performed a block dissection of all chest wall muscles and removal of axillary nodes.[12]

But the first indications that BC was a systemic disease also appeared during this period. In 1896, George Thomas Beatson found that oophorectomy could temporarily regress some metastatic tumors and shed light on the hormonal dependency of some cancers pioneered endocrine therapy.[11,12] By the middle of the 20th century, scientists understood that BC frequently travels microscopically early in its course and that surgery alone is not enough. Randomized clinical trial, the work of Bernard Fisher and National Surgical Adjuvant Breast and Bowel Project showed that lumpectomy plus radiation achieves survival equal to radical mastectomy for early stage disease.[13,14]

Modern management has been shaped by advances in imaging, radiotherapy, and molecular biology. Mammography emerged from early X-ray technology, while targeted therapies transformed outcomes in the late 20th century. The identification of *HER2* amplification led to the approval of trastuzumab in 1998, dramatically improving survival for *HER2*-positive patients.[14] The 21st century has further refined treatment through gene-expression profiling, defining molecular subtypes and enabling personalized management with biomarkers such as *Ki-67* and recurrence-score assays.[11]

Epidemiology

BC is the most frequently diagnosed malignancy worldwide and represents a major public health challenge. In 2020 alone, more than 2.3 million new cases and about 685,000 deaths were reported globally, accounting for one in every eight cancer diagnoses among females. Incidence rates vary widely across regions, ranging from below 40/100,000 females in several Asian and African countries to more than double this figure in highly developed regions such as Australia/New Zealand, North America, and Western Europe.[15] Higher incidence is strongly associated with high Human Development Index (HDI) levels, whereas low- and middle-HDI countries experience a disproportionately high share of global BC deaths despite having lower incidence rates. These global patterns and disparities in incidence and mortality are summarized in [Table 1, Row: Global]. Looking ahead, the overall burden of BC is projected to rise substantially by 2040, driven primarily by population growth and aging demographics.[2,15]

Table 1: Literature summary of epidemiological figures

Category	Female ASIR	ASIR ↑	MIR	Citation
Global	47.8 (2020)	128.30%	0.30 (2018)	[16]
Regional (MENA)	37.5 (2019)	90.90%	0.41 (2019)	[17]
National (Iraq)	32.81 (2000–2015)	5.40% (APC**)	0.415 (2019)	[10]
Local (KRG*)	17.9 (2011–2013)	NA	NA	[18]

*Kurdistan region in Iraq, **average percentage change, ↑Increase in percentage, NA: Not available, ASIR: Age-standardized incidence rate

Regional BC Burden

In line with global trends, the Middle East and North Africa (MENA) region faces a rapidly increasing BC burden.[4] From 1990 to 2019, the regional ASIR nearly doubled, rising from 19.6 to 37.5/100,000 females – a 90.9% increase – while mortality rose by 24% to 15.2/100,000. Decomposition analysis shows incidence growth as the main driver, reflecting westernized lifestyle shifts, including rising obesity, physical inactivity, and reproductive pattern changes. Rates vary widely within the region, with higher-SDI countries such as Lebanon, Qatar, and Bahrain showing the highest incidence; Lebanon recorded 122.5/100,000 in 2019.[15]

Despite lower incidence, conflict-affected and resource-limited countries such as Afghanistan, Yemen, and Sudan face poor outcomes, shown by high mortality-to-incidence ratios and elevated Years of life lost/years lived with Disability.[19] Major modifiable contributors to regional Disability-adjusted life years include high fasting plasma glucose, passive smoking, and high red-meat intake. Persistent challenges include younger age at diagnosis, aggressive tumor characteristics, limited screening programs, and weak data systems.[4]

Iraq and Kurdistan

BC remains the leading malignancy among females in Iraq, with steadily rising incidence rates.[20] Between 2000 and 2015, the national ASIR increased by an average of 5.4%, reaching 32.81/100,000 females, higher than neighboring countries such as Iran, Oman, and Saudi Arabia. In Kurdistan, patients present at a mean age of 50 for mastectomy and 46 for Tru-Cut biopsy.[18] Invasive ductal carcinoma dominates (>84%), with Luminal A being the most frequent molecular subtype. Most diagnoses occur at advanced stages (II–III), highlighting the urgent need for awareness, early detection, and improved data collection.[18]

Screening and early detection

Screening and early detection are crucial for improving BC outcomes globally. Screening involves organized, population-based testing of asymptomatic women, typically using mammography, to detect malignancy before symptoms arise.[15] Early detection more broadly promotes awareness of BC symptoms and ensures timely diagnosis and treatment once lesions appear. Developed countries achieve higher survival rates through effective screening programs, with the WHO recommending mammography for women aged 50–69 in well-resourced settings. Mammography reduces mortality and increases the detection of small, early-stage tumors.[15,16]

Low- and middle-income countries face infrastructural and cost barriers to mammography, making early symptomatic diagnosis a priority. Clinical breast examination serves as a low-cost alternative and aids in downstaging disease.[16] While high-income countries detect only ~15% of cases at advanced stages, approximately 77% of staged cases in sub-Saharan Africa present late,[15] highlighting global disparities in detection and outcomes.

The MENA region faces major BC detection challenges, with many countries lacking national screening programs, leading to delayed diagnosis and higher disease burden.[15,17] Sociocultural barriers, including fatalism and fear of mastectomy, further delay presentation. While Kuwait and Lebanon maintain mammography for women over 40, countries like Afghanistan, Libya, Sudan, and Yemen lacked active screening until 2019. In Kurdistan, Iraq, nearly two-thirds of cases in Erbil are diagnosed at Stage II or III due to poverty, low awareness, and cultural barriers.[18] Targeted public health interventions are urgently needed to improve early detection, enhance treatment outcomes, and reduce mortality. A comparison of breast cancer screening and early detection strategies is provided in Table 2.

Pathophysiology

BC is the most commonly diagnosed solid tumor among women and a leading cause of cancer-related mortality.[21,22] It arises from uncontrolled proliferation of epithelial breast cells, forming invasive tumors and exhibiting substantial clinical and molecular heterogeneity. Etiology involves genetic predisposition, hormonal fluctuations, environmental exposures, and microenvironmental factors,[22,23] Molecular classification, based on *ER*, *PR*, and *HER2* status, identifies luminal, *HER2*-positive, and triple- negative subtypes.[21,24] Luminal A tumors are hormone-sensitive with a favorable prognosis, while Luminal B and *HER2*-positive tumors are more aggressive but respond to targeted therapies. TNBC lacks all three receptors, is highly aggressive, and relies primarily on chemotherapy. Understanding BC molecular signatures is crucial for precision medicine and improved outcomes.

Signs and Symptoms

The clinical presentation of BC varies widely among women, ranging from asymptomatic detection through screening to advanced local or systemic disease.[22] The most common initial sign is a painless, palpable breast mass, often detected through mammography or self-examination, which is crucial for early diagnosis and improved outcomes.[25] Local progression may involve the axillary lymph nodes, sometimes presenting as a palpable mass or occult metastasis without an identifiable primary tumor, which occurs in 0.3–1% of cases.[22] Advanced disease can manifest as skin changes, thickening, nipple inversion, or discharge, occasionally accompanied by localized pain. Timely recognition of these signs is critical, as delayed diagnosis often results in more advanced stages and poorer prognosis.[25] Routine screening programs and patient awareness are therefore essential to enhance early detection and survival.

Risk Factors of BC

BC risk factors are multifactorial and can be categorized as modifiable or non-modifiable.[26] Modifiable factors involve lifestyle, environmental, and behavioral aspects. Obesity, high-fat diets, low fruit and vegetable intake, physical inactivity, smoking, alcohol use, Vitamin D deficiency, and low socioeconomic status significantly elevate BC risk, although their relative contributions are not uniform, with obesity and physical inactivity exerting particularly strong associations among postmenopausal women.[27,28] Hormonal influences, including HRT, oral contraceptive use, and short or absent breastfeeding, also contribute.[29,30] Addressing these factors is critical for prevention and early detection. Non-modifiable

factors include female sex, increasing age, reproductive history, and genetic predisposition, such as *BRCA1/2* mutations and positive family history,[31] these intrinsic factors inform risk assessment and therapeutic decisions.

Age Specific Differences: Biological and Clinical Divergence

BC is a highly heterogeneous disease, with distinct clinical and biological characteristics observed between postmenopausal and premenopausal women. These differences lead to variations in outcomes and necessitate age- or menopause-specific management strategies. Many studies therefore classify patients by menopausal status or age thresholds, commonly above or below 40 years.[32] Etiological factors also differ by age group. Postmenopausal BC is more strongly associated with advanced age, obesity, HRT, and cumulative lifetime estrogen exposure. In contrast, premenopausal BC is linked to early menarche, nulliparity, delayed first childbirth, and family history of BC, reflecting distinct hormonal and reproductive risk profiles.[33]

METHODS

This is a cross-sectional study conducted while utilizing hospital data from Hiwa Cancer Hospital and Zhianawa Hospital. Between January 01, 2015, and December 31, 2024, a total of 41,444 female BC patients were treated at Hiwa Cancer Hospital. Of these, 12,476 patients were postmenopausal (according to international guidelines) and were included in the population-based analysis of 10-year BC incidence trends. The study population comprised all postmenopausal women diagnosed with primary BC between 2015 and 2025 who were residents of Sulaimani Governorate. Non-resident of Sulaimani Governorate and patients with recurrent BC were excluded from the study. From this population, 496 patients who met the predefined eligibility criteria and had complete data were enrolled for detailed evaluation of demographic, clinical and molecular characteristics, while individuals who declined participation were excluded.

The sample size was calculated using a single proportion formula:

$$n = (Z^2 \times P \times (1 - P))/d^2 \quad (1)$$

where n is the needed sample size,

p is the estimated prevalence {0.5 for maximum variability}, d is the margin of error (here we put 0.05),

Z is Z -score the degree of accuracy at 95% confidence interval level is 1.96.

Data Collection

It was conducted after obtaining informed verbal consent from participants through phone calls and face-to-face interviews, supplemented by a review of medical records to verify information and obtain additional clinical details. Participants were re-contacted when necessary to complete missing data. A structured questionnaire was developed based on an extensive review of relevant literature and refined before data collection. Only study-related data were extracted, and confidentiality was strictly maintained.

The questionnaire captured demographic characteristics, reproductive and menstrual history, lifestyle factors, medical and surgical history, tumor features, treatment details, and prognosis. Tumor characteristics included histopathological findings, lymph node involvement, molecular and immunohistochemical markers, and imaging results. Treatment-related variables assessed surgical approaches, chemotherapy, radiotherapy, hormonal therapy, and treatment response. Disease staging followed the American Joint Committee on Cancer (TNM) criteria. Molecular subtypes were classified using immunohistochemical surrogate definitions, including Luminal A, Luminal B, *HER2* overexpression, and TNBC.

Ethical approval was obtained from the Ethical Committee of the College of Medicine, University of Sulaimani (Approval No.323, approved on October 13, 2024), with additional permissions from the Directorate of Health-Sulaimani, Hiwa Oncology and Hematology Hospital, Zhianawa Hospital, and the Statistics Office in Sulaimani. The study used secondary medical records, and informed verbal consent was obtained from participants, ensuring confidentiality and the right to withdraw at any time.

Statistical Analysis

Non-parametric data were analyzed using SPSS V28. Categorical variables were summarized using frequencies and percentages. Group comparisons were performed using Pearson's Chi-square test, Fisher's exact test, or the Fisher-Freeman-Halton exact test, as appropriate. Temporal trends in ASIRs were evaluated using joinpoint regression analysis version 5.4.0, with estimation of annual percent change (APC). A $P \leq 0.05$ was considered statistically significant.

RESULTS AND DISCUSSION

Incidence Rate

Table 3 shows the age-specific and ASIRs of female BC in Sulaimani from 2015 to 2024. The highest incidence was observed among women aged 50–59 years, followed by those aged 65–69 years. Between 2015 and 2024, the overall ASIR increased from 119.1 to 164.0 per 100,000, corresponding to a 37.8% rise. When comparing the two periods (2015–2019 and 2020–2024), the ASIR showed a modest overall increase of 2.4%, suggesting that the rate has recently stabilized. The most pronounced growth was observed in the 55–59 and 70–74 age groups, with increases exceeding 80%. Conversely, a declining trend was noted in the 45–49 and 60–64 age groups.

Figure 1 showed an overall increasing trend with an APC of +1.5% (p>0.05). A model with one joinpoint was selected, identifying a change in 2017. Between 2015 and 2017, the ASIR increased markedly (APC = +10.24%), followed by a nearly stable pattern from 2017 to 2024 (APC = +0.02%). This suggests that incidence rates rose in the early part of the period and then plateaued in the later years.

Figure 2 demonstrates the proportional distribution of age groups among postmenopausal BC patients over 10 years. Women aged 55–64 years consistently represented the majority

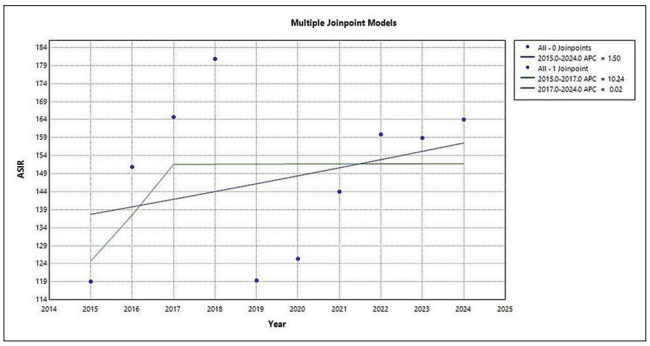

Figure 1: Joinpoint regression analysis of age-standardized incidence rates for female breast cancer in Sulaimani during 2015–2024

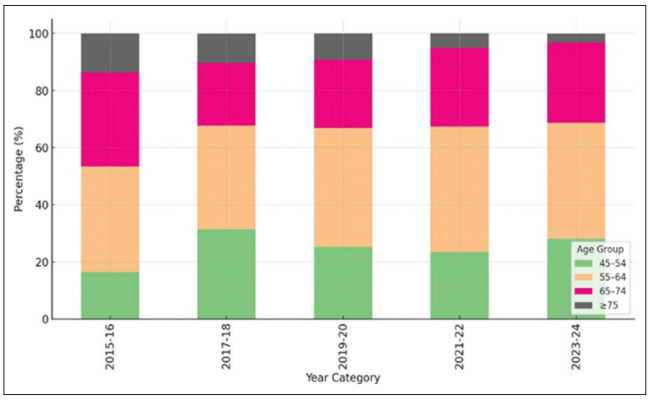

Figure 2: Age group distribution of postmenopausal breast cancer (2015–2024)

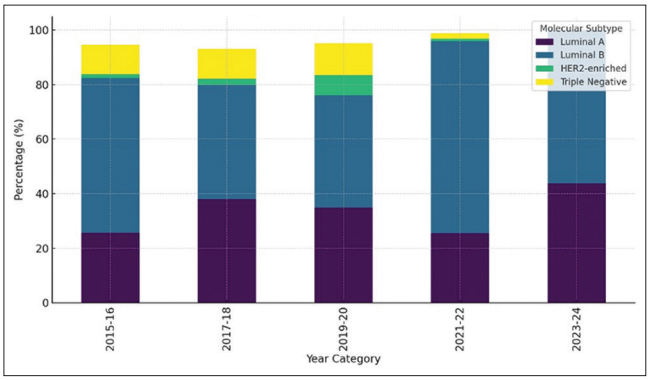

Figure 3: Molecular subtype distribution of breast cancer (2015–2024)

across all time periods. The 45–54 age group increased notably during 2017–2018, while the ≥75 age group showed a gradual decline, decreasing from 13.7% in 2015–2016 to only 3.1% in 2023–2024. These trends indicate a shift toward younger postmenopausal patients being diagnosed over time.

Table 4 presents joinpoint regression analysis showed varying APCs across age groups between 2015 and 2024. While most cohorts demonstrated non-significant trends, the 75–79 age group exhibited a significant decline from 2015 to 2021 (APC = −29.89%, P = 0.007) followed by a significant increase from 2021 to 2024 (APC = 83.87%, P = 0.037). No statistically significant changes were observed in the remaining age groups, including those aged 80 years and older. The lack of statistically significant joinpoint trends across most age groups supports the observed stabilization of overall ASIRs in the later study period, as reflected by the minimal change between 2015–2019 and 2020–2024.

Demographic and Clinical Characteristics

Table 5 summarizes the demographic and clinical features of 496 postmenopausal women diagnosed with BC between 2015 and 2024. Age distribution ranged primarily between 55 and 64 years, representing the largest proportion across all cohorts (36.2–43.9%), followed by 65–74 years (22.0–32.9%). The age category showed no statistically significant difference across years (P = 0.303). Marital status demonstrated a statistically significant variation over time (P = 0.003). The majority of participants were married (86.7–93.9%), while single women increased gradually from 1.4% in 2015–2016 to 6.3% in 2023–2024. Blood group distribution differed non-significantly across the study period (P = 0.086). Blood group O remained predominant (39.8–59.4%), followed by Group A (26.0–41.8%). Blood Group AB consistently represented the smallest proportion (3.1–13.7%). Body mass index (BMI) categories showed significant variation (P = 0.032). Obesity (≥30 kg/m^2) was most common during 2019–2020 (65.0%), with a decline thereafter. The proportion of overweight women (25–29.9 kg/m^2) increased notably in the 2023–2024 cohort (50.0%). No significant difference was observed in duration since menopause across the study period (P = 0.071). Women within 0–10 years post-menopause increased progressively from 38.4% to 56.1% between 2015 and 2022, stabilizing at 50.0% in the latest cohort.

Molecular Subtype Distribution

Table 6 presents the molecular subtype patterns based on immunohistochemical classification.

The Luminal A subtype ranged from 25.7% to 43.8%, showing a moderate increase over time (P = 0.098). Luminal B subtype exhibited the highest prevalence overall (41.1–70.4%), with a statistically significant variation across years (P < 0.001).

The *HER2*-enriched subtype showed fluctuating but declining occurrence (P = 0.041), while Triple Negative tumors decreased significantly (P = 0.009), reaching 0% in 2023–2024.

It shows the variation in molecular subtypes across the study years. Luminal B was the most frequent subtype in most years, peaking in 2021–2022 (70.4%). Luminal A fluctuated but increased in the final period (43.8%). Triple-negative and *HER2*-enriched subtypes declined sharply, reaching 0% in 2023–2024. Overall, the graph suggests a shifting molecular landscape toward more hormone receptor-positive tumors.

DISCUSSION

This population-based study demonstrates a clear temporal evolution in the incidence of postmenopausal BC in Sulaimani over the period 2015–2024. The overall increase in ASIRs, particularly during the early years of the study, followed

Table 2: Comparative strategies for breast cancer screening and early detection

Category	Detection strategy	Typical diagnosis stage	Policy/infrastructure context	Citation
Global (vHDI**)	Organized MA** (Age 50–69 years**)	Early Stage (<15% Stages III/IV**)	Well-resourced settings mandate quality screening and follow-up	[16]
Global (LMI**)	Early Diagnosis (CBE**); symptom awareness priority	Advanced Stages (≈77% III/IV in SSA**)	Screening neither cost-effective nor feasible; focus pivots to downstaging	[16]
Regional (MENA*)	BHGI** advocates awareness, education, self-exam	Late Diagnosis operational (≥40 years)	Many countries lacked (High MIR**) in active programs (2019); deprived states. Kuwait/Lebanon	[17]
Local (KRG*)	Targeted public health interventions address local constraints	Advanced Stages (Stages II/III** ≈low 2/3 cases)	Diagnosis severely challenged by poverty, awareness, and sociocultural obstacles	[18]

*Kurdistan Region in Iraq (KRG). **vHDI: Very high human development index, LMI: Low/medium income, MA: Mammography, CBE: Clinical breast examination, SSA: Sub-Saharan Africa, BHGI: Breast health global initiative, MIR: Mortality to incidence ratio, Stages III/IV: Stages III and IV, Stages II/III: Intermediate and Advanced Stages II and III

Table 3: Age-specific and age-standardized incidence rates (ASIRs) of female breast cancer in Sulaimani from 2015 to 2024

Age group	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80+	Total	ASIR
WHO	Weight	4.56	3.7	2.96	2.21	1.52	1.03	0.68	0.47	17.13
2015	109.93	160.28	40.8	138.71	225.62	97.25	107.54	13.68	892.81	119.07
2016	157.62	186.18	87.63	178.14	189.33	87.8	156.7	82.77	1126.16	150.87
2017	144.75	223.21	87.32	160.63	316.64	130.79	126.86	41.74	1231.94	164.7
2018	155.93	276.02	138.39	161.76	263.76	112.56	86.26	49.1	1243.79	180.85
2019	124.41	144.39	93.38	122.39	140.6	111.79	59.85	56.59	853.41	119.36
2020	129.34	141.77	90.1	117.18	222.1	93.94	93.03	21.4	908.85	125.38
2021	147.36	198.6	141.87	103.1	206	68.29	7.44	49.9	922.58	143.99
2022	105.69	250.17	187.78	85.24	226.4	180.63	33.65	72.16	1141.71	159.88
2023	108.6	165.34	211.95	138.88	185	283.33	118.05	58.52	1269.68	158.91
2024	102.71	237.37	204.64	97.56	181.67	232.58	124.25	88.53	1269.32	164.03
Overall point-to-point change (%)	−5.70	48.10	401.50	−29.70	−19.50	139.20	15.50	547.20	42.20	37.80
Overall change over periods (%)	−14.20	0.30	86.90	−28.80	−10.10	59.00	−29.90	19.10	3.11	2.40

Table 4: Joinpoint regression analysis showed varying annual percent changes across age groups between 2015 and 2024

Cohort	Segment	Lower endpoint	Upper endpoint	APC	Lower C1	Upper C1	*P*-value
45–49-1 Joint Point	1	2015	2017	15.69	−6.53	45.99	0.1999
45–49-1 Joint Point	2	2017	2024	−5.88	−26.15	2.97	0.0875
50–54-1 Joint Point	1	2015	2020	−1.96	−37.57	92.37	0.5878
50–54-1 Joint Point	2	2020	2024	6.11	−46.09	69.87	0.4567
55–59-1 Joint Point	1	2015	2017	40.36	−1.72	128.87	0.0675
55–59-1 Joint Point	2	2017	2024	12.16	−33.8	50.21	0.3311
60–64-1 Joint Point	1	2015	2022	−7.37	-29.1	34.16	0.2511
60–64-1 Joint Point	2	2022	2024	5.09	−29.44	35.49	0.8006
65–69-1 Joint Point	1	2015	2017	8.76	−13.48	47.78	0.7722
65–69-1 Joint Point	2	2017	2024	−4.31	−30.3	18.54	0.527
70–74-1 Joint Point	1	2015	2021	−1.17	−38.68	56.24	0.5758
70–74-1 Joint Point	2	2021	2024	45.93	−5.52	144.59	0.0587
75–79-1 Joint Point	1	2015	2021	**−29.89**	−62.9	−11.82	0.0095
75–79-1 Joint Point	2	2021	2024	**83.87**	1.84	343.33	0.0375
80+ - 1 Joint Point	1	2015	2017	43	−15.96	149.88	0.2475
80+ - 1 Joint Point	2	2017	2024	5.31	−41.19	72.7	0.9954

Annual percent change (APC) and corresponding 95% confidence intervals were estimated using joinpoint regression analysis with the Monte Carlo permutation test. A $P<0.05$ was considered statistically significant. The bold values in Table 4 indicate statistically significant annual percent changes (APC) at $p < 0.05$.

Table 5: Demographic and clinical characteristics by year category

Characteristic						
Blood Group	**2015–2016**	**2017–2018**	**2019–2020**	**2021–2022**	**2023–2024**	***P*-value**
A	19 (25.7)	43 (33.3)	59 (36.2)	41 (41.8)	7 (21.9)	0.086
AB	10 (13.5)	7 (5.4)	13 (8.0)	7 (7.1)	1 (3.1)	
B	15 (20.3)	29 (22.5)	20 (12.3)	11 (11.2)	5 (15.6)	
O	30 (40.5)	50 (38.8)	71 (43.6)	39 (39.8)	19 (59.4)	
Age category						
45–54 years	12 (16.2)	40 (31.0)	41 (25.2)	23 (23.5)	9 (28.1)	0.303
55–64 years	27 (36.5)	47 (36.4)	68 (41.7)	43 (43.9)	13 (40.6)	
65–74 years	24 (32.4)	28 (21.7)	39 (23.9)	27 (27.6)	9 (28.1)	
≥75 years	11 (14.9)	14 (10.9)	15 (9.2)	5 (5.1)	1 (3.1)	
Marital status						
Married	69 (93.2)	116 (89.9)	153 (93.9)	85 (86.7)	30 (93.8)	0.003
Single	1 (1.4)	3 (2.3)	9 (5.5)	10 (10.2)	2 (6.3)	
Widowed	4 (5.4)	10 (7.8)	1 (0.6)	3 (3.1)	0 (0.0)	
Body mass index category						
Normal (18.5–24.9)	11 (14.9)	16 (12.4)	17 (10.4)	15 (15.3)	6 (18.8)	0.032
Overweight (25–29.9)	25 (33.8)	43 (33.3)	40 (24.5)	35 (35.7)	16 (50.0)	
Obese (≥30)	38 (51.4)	70 (54.3)	106 (65.0)	48 (49.0)	10 (31.3)	
Menopause years						
0–10 years	28 (37.8)	62 (48.1)	92 (56.4)	55 (56.1)	16 (50.0)	0.071
>10 year	46 (62.2)	67 (51.9)	71 (43.6)	43 (43.9)	16 (50.0)	

Table 6: Distribution of breast cancer molecular subtypes by year category (n=496)*

Molecular subtype	**2015–2016**	**2017–2018**	**2019–2020**	**2021–2022**	**2023–2024**	***P*-value**
Luminal A	19 (25.7)	49 (38.0)	57 (35.0)	25 (25.5)	14 (43.8)	0.098
Luminal B	42 (56.8)	54 (41.9)	67 (41.1)	69 (70.4)	18 (56.2)	<0.001
HER2 enriched	1 (1.4)	3 (2.3)	12 (7.4)	1 (1.0)	0 (0.0)	0.041
Triple negative	8 (10.8)	14 (10.9)	19 (11.7)	2 (2.0)	0 (0.0)	0.009

by stabilization after 2017, reflects an epidemiological transition rather than a continuous rise in disease risk. Recent locally generated evidence from Sulaimani has similarly documented changes in the clinicopathological and molecular profiles of BC patients, supporting the interpretation that improved diagnostic coverage, pathology services, and case ascertainment have substantially influenced reported incidence rates in the region.[34] At the national level, analyses of Iraqi cancer registry data have consistently shown rising BC incidence since the early 2000s, attributed mainly to improved reporting and expanding oncology services.[35,36] Comparable trends have been observed across the Kurdistan Region, where institutional series have reported increasing BC detection among postmenopausal women in parallel with health system strengthening.[37]

A prominent finding of the present study is the shift in disease burden toward younger postmenopausal age groups, particularly women aged 55–59 years, who demonstrated the most pronounced increase in ASIRs. This observation is consistent with locally published data from Sulaimani, which describe a concentration of BC diagnoses in the late 50s, accompanied by a predominance of hormone receptor–positive tumors.[34] Iraqi studies have similarly reported a younger median age at diagnosis compared with Western populations, reflecting distinct demographic, reproductive, and lifestyle patterns.[36]

The demographic and clinical characteristics identified in this cohort are consistent with established risk factors for postmenopausal BC. The high prevalence of overweight and obesity observed throughout the study period is of particular importance, as excess adiposity is a well-established driver of estrogen-mediated carcinogenesis in postmenopausal women.[38] Local research from Kurdistan has demonstrated a direct association between higher body mass index and increased ER expression, reinforcing the biological plausibility of the associations observed in the current study.[39] National and regional investigations have similarly documented obesity as a significant risk factor for BC among postmenopausal women.[40,41]

The molecular subtype distribution observed in this study

shows a predominance of hormone receptor–positive tumors, particularly Luminal B and Luminal A, with a concurrent decline in triple-negative and HER2-enriched cancers over the study period. This pattern closely mirrors recent molecular profiling studies from Sulaimani, which reported a similar dominance of luminal subtypes among BC patients in the region.[34] Comparable molecular subtype distributions have been reported across Iraq and neighboring countries, where luminal tumors constitute the majority of postmenopausal BC cases.[42,43]

However, the apparent disappearance of triple-negative and HER2-enriched tumors in the most recent cohort should be interpreted with caution, as it may reflect improved diagnostic practices and earlier detection over time, as well as temporal variability, rather than true epidemiological absence of these biologically aggressive subtypes.

CONCLUSION

This study highlights the increasing burden of BC among postmenopausal women in Sulaimani, reflecting trends observed at the national level and across the MENA region. The observed rise in incidence emphasizes the need for strengthened early detection and screening strategies. Molecular subtype distribution plays a critical role in prognosis and treatment planning, with hormone receptor-positive tumors predominating and targeted therapies offering improved outcomes. The high prevalence of obesity among affected women underscores the importance of addressing modifiable risk factors through preventive public health interventions. Overall, these findings provide valuable local epidemiological evidence to inform healthcare planning, support personalized management strategies, and guide future BC control efforts in the region.

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