

## Special Article



# Breast Cancer Statistics in Korea, 2021

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## ABSTRACT

The Korean Breast Cancer Society (KBCS) has collected nationwide registry data on clinicopathologic characteristics and treatment since 1996. This study aimed to analyze the clinical characteristics of breast cancer in Korea and assess changes in breast cancer statistics for 2021 using data from the KBCS registry and the Korean Central Cancer Registry. In 2021, 34,628 women were newly diagnosed with breast cancer. The median age of women diagnosed with breast cancer was 53.4 years, with the highest incidence occurring in the 40–49 age group. The most common molecular subtype was hormone receptor-positive and human epidermal growth factor receptor 2 (HER2)-negative, accounting for 69.1% of cases, while HER2-positive subtypes comprised 19.3%. During the coronavirus disease 2019 pandemic, the national breast cancer screening rate declined. However, the incidence of early-stage breast cancer (stages 0 and I) continued to increase, accounting for 65.6% of newly diagnosed cases in 2021. Our results showed that the overall survival rate for patients with breast cancer has improved, primarily due to a rise in early-stage diagnoses and advancements in treatment.

**Keywords:** Breast Neoplasms; COVID-19; Incidence; Republic of Korea; Survival

## INTRODUCTION

Breast cancer is the most commonly diagnosed cancer among women worldwide, and its incidence continues to rise annually. The International Agency for Research on Cancer

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#### Conflict of Interest

The authors declare that they have no competing interests.

#### Data Availability

In accordance with the ICMJE data sharing policy, the authors have agreed to make the data available upon request.

#### Author Contributions

Conceptualization: Cha C, Han J; Data curation: Shin HC, Han J, Choi JE, Kim JH, Nam SE, Kang YJ, Kim Z; Formal analysis: Park CS, Shin HC, Choi JE, Kim JH, Nam SE, Yoon TI, Kang YJ; Investigation: Kim HA; Methodology: Jung KW; Project administration: Jung SY; Resources: Park CS, Jung KW, Lee SB, Yoon TI; Software: Lee SB; Supervision: Jung SY, Kim HA; Visualization: Cha C; Writing - original draft: Cha C, Kim HA; Writing - review & editing: Cha C, Park CS, Kim HA.

reported that in 2022, there were 2,296,840 newly diagnosed cases of breast cancer, accounting for 23.8% of all cancers in women [1]. Furthermore, it is the leading cause of cancer deaths among women globally. According to the Global Cancer Incidence, Mortality, and Prevalence (GLOBOCAN) databases, 666,103 deaths from breast cancer were reported in 2022, accounting for 15.4% of all women who died of cancer in that year. In Korea, the Korean Central Cancer Registry (KCCR) reported that breast cancer was the most newly diagnosed cancer in women in 2021, comprising 21.5% of all new cases, and ranking as the fifth most common diagnosed cancer among both sexes [2].

Since 1996, the Korean Breast Cancer Society (KBCS) has maintained a registry to collect clinical information on breast cancer, including age, sex, disease stage, therapeutic options, and molecular subtype. Using this registry, the KBCS publishes statistical reports annually and distributes data to researchers who propose studies aimed at enhancing the understanding of breast cancer in Korea. In this study, we aimed to analyze the clinicopathologic characteristics, treatment patterns, and survival outcome of breast cancer in Korea in 2021.

## METHODS

### Data sources

All patients with newly diagnosed breast cancer in Korea in 2021 were enrolled in this study. Two data sources were used: 1) the KCCR and 2) the KBCS. The Institutional Review Board of the Korean Cancer Center Hospital approved this study (approval No.: KIRAMS 2024-07-002).

The KCCR is a nationwide population-based cancer registry that provides annual statistics on cancer incidence and survival rate by age group and region. We calculated the incidence rate, survival rates, and median age (or age distribution) of newly diagnosed patients with breast cancer using KCCR data.

The KBCS collects detailed clinical data on patients with breast cancer, including age, body mass index, disease stage, treatment options, pathologic results, and molecular subtype, using an online registry system (<https://registry.kbcs.or.kr/ecrf>). Treatment patterns and molecular subtypes were analyzed using the KBCS registry. This study included both invasive cancers (International Classification of Diseases [ICD]-10 code: C50) and ductal carcinoma *in situ* (ICD-10 code: D05) as non-invasive cancers from the KCCR and KBCS registries. Patients with lobular carcinoma *in situ* were excluded from the KBCS but included in the KCCR. The GLOBOCAN database only includes invasive cancers (ICD-10 code: C50).

### Statistical analyses

The incidence rate was expressed as crude rates (CRs) per 100,000 people and as age-standardized rate (ASR). The CR was defined as the total number of newly diagnosed patients in a given year divided by the mid-year population. The ASR, a widely used measure for comparing disease incidence across populations, is a weighted average of age-specific rates, with the weights corresponding to the proportions of the corresponding age groups in a standard population. In this study, the ASR was standardized using Segi's world standard population [3]. The ASR trend was summarized as the annual percentage change (APC). The average APC (AAPC) was calculated to demonstrate trends over a specific time interval, expressing the AAPC over multiple years. The APC and AAPC were analyzed using the joinpoint model (version 4.3.1; National Cancer Institute, Bethesda, USA).

The survival rate of patients with breast cancer diagnosed between 1993 and 2021 was calculated based on follow-up data through December 31, 2022. The relative survival rate represents the ratio of observed survival in patients with breast cancer to the expected survival of the general population, adjusting for other causes of death. Five-year relative survival rates were calculated and compared according to the year of diagnosis, patient age, and disease stage. The stages at diagnosis were categorized as localized, regional, or distant based on classifications proposed by the Surveillance, Epidemiology, and End Results (SEER) program. The localized stage refers to malignancies confined to the breast, the regional stage to cancers that have spread to nearby organs or lymph nodes but not beyond, and the distant stage to cases where the cancer has metastasized to distant organs.

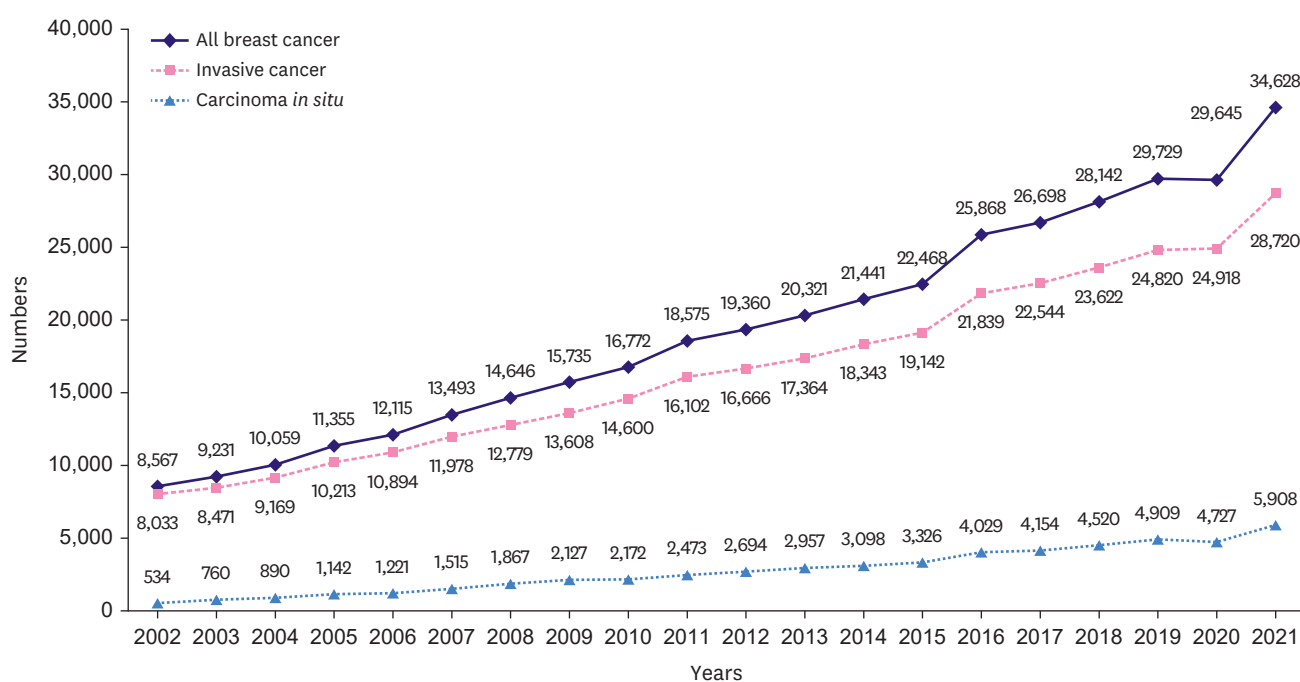
Statistical significance was defined as a  $p$ -value  $< 0.05$ . All statistical analyses were performed using SPSS software (version 20.0; IBM Corp., Armonk, USA).

## RESULTS

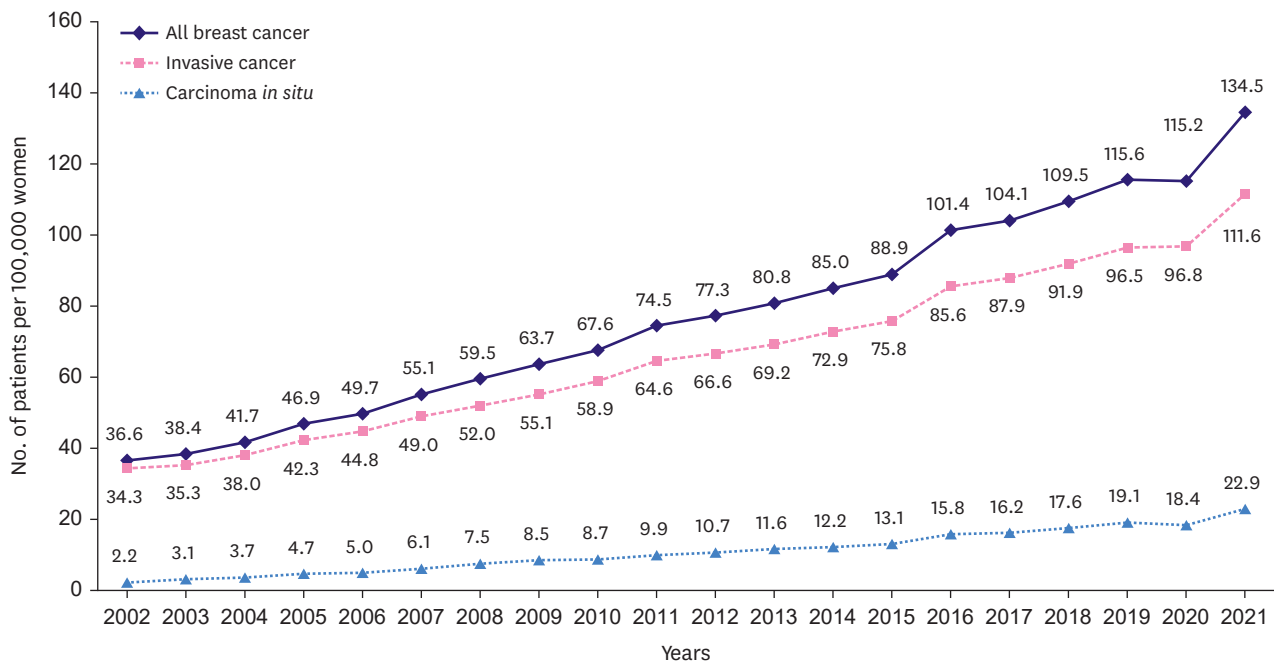
### Newly diagnosed cases of breast cancer in Korea in 2021

#### Incidence

According to KCCR data, 34,780 patients were newly diagnosed with breast cancer in Korea in 2021. Invasive breast cancer accounted for 28,861 cases (83.0%), while *in situ* breast cancer accounted for 5,919 cases (17.0%). Of these, 34,628 (99.6%) were women, and 152 (0.4%) were men (**Figure 1**). The CR for breast cancer in 2021 was 134.5 per 100,000 women, marking an increase of 19.3 compared to 2020 (**Figure 2**). The CR for invasive breast cancer increased 4.4-fold over 21 years, from 25.4 in 2000 to 111.6 in 2021, while the CR for *in situ* breast cancer increased 14.3-fold, from 1.6 in 2000 to 22.9 in 2021.



**Figure 1.** Number of women newly diagnosed with breast cancer, Korea.



**Figure 2.** Crude rate of breast cancer in women, Korea, 2002 to 2021.

The ASR for breast cancer per 100,000 women was 132.8, with ASRs for invasive cancer and carcinoma *in situ* being 109.9 and 22.9 cases per 100,000 women, respectively. According to a KCCR report, the total number of women newly diagnosed with cancer in 2021 was 133,800. Breast cancer remained the most common cancer type in women, followed by thyroid cancer [4]. The APC for breast cancer in women between 1999 and 2021 was 6.0%, with invasive cancer showing an APC of 5.4%, while *in situ* cancer had a more pronounced APC of 12.1%.

#### Age distribution

The median age of women with invasive breast cancer was 53.4 years, while the median age for those with *in situ* breast cancer was 50.7 years, based on KCCR data (**Figure 3**). The age group with the highest number of newly diagnosed breast cancers was the 40–49-year-old group (31.1% of cases), followed by the 50–59-year-old group (29.1% of cases) (**Figure 4**). According to the 2021 KBCS registry, the youngest patient with breast cancer was 19 years old, while the oldest was 92 years old.

#### Stages and molecular subtypes

When classified according to the pathological stage based on the 8th edition of the American Joint Committee on Cancer and the International Union Against Cancer guidelines, most patients (44.4%) had stage I cancer, followed by stage II (25.3%) and *in situ* cancer (16.6%), as reported in the KBCS registry (**Table 1**) [5]. Among the 12,537 patients included in the KBCS registry, 9,424 (75.2%) had estrogen receptor-positive tumors, and 8,055 (64.2%) had progesterone receptor-positive tumors. Additionally, out of 11,139 patients with available human epidermal growth factor receptor 2 (HER2) data, 2,146 (19.3%) showed HER2-positive tumors.

Patients were classified into four molecular subtypes based on their hormone receptor (HR) and HER2 statuses. The most common subtype was HR-positive/HER2-negative (69.1%),

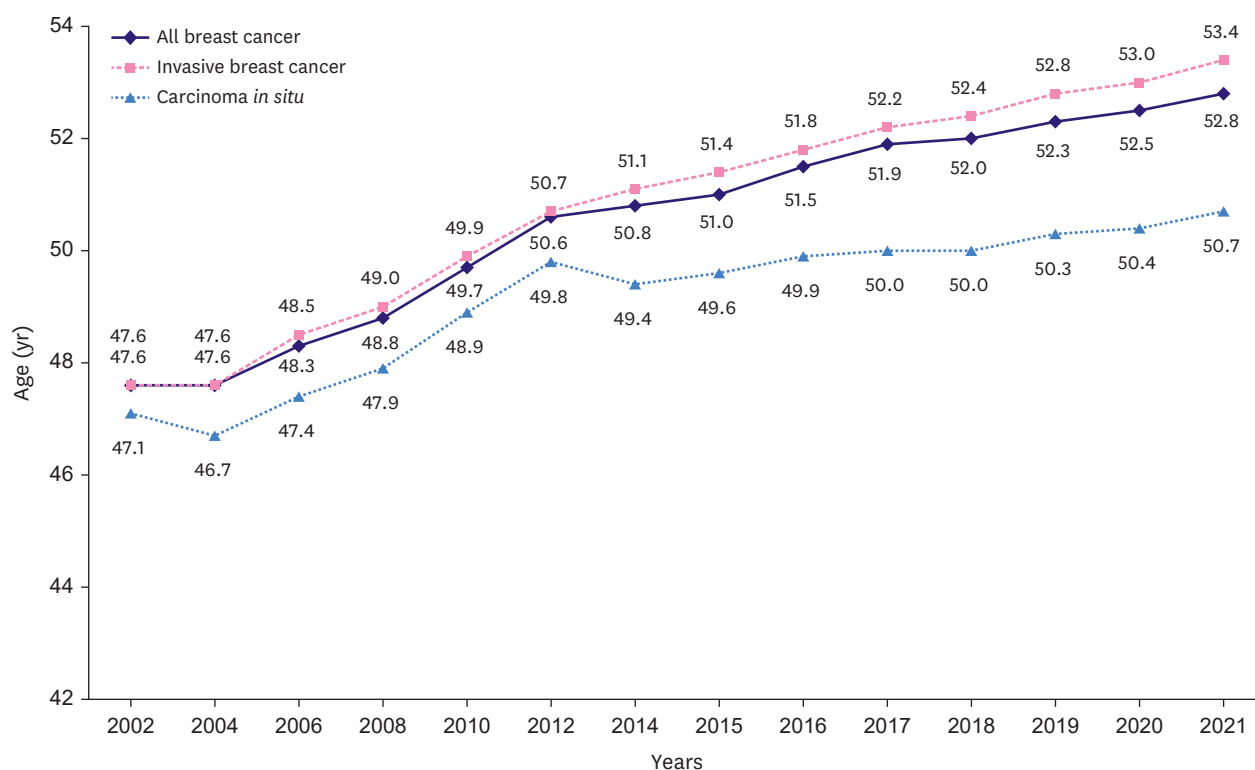


Figure 3. Median age of women with newly diagnosed breast cancer, Korea.

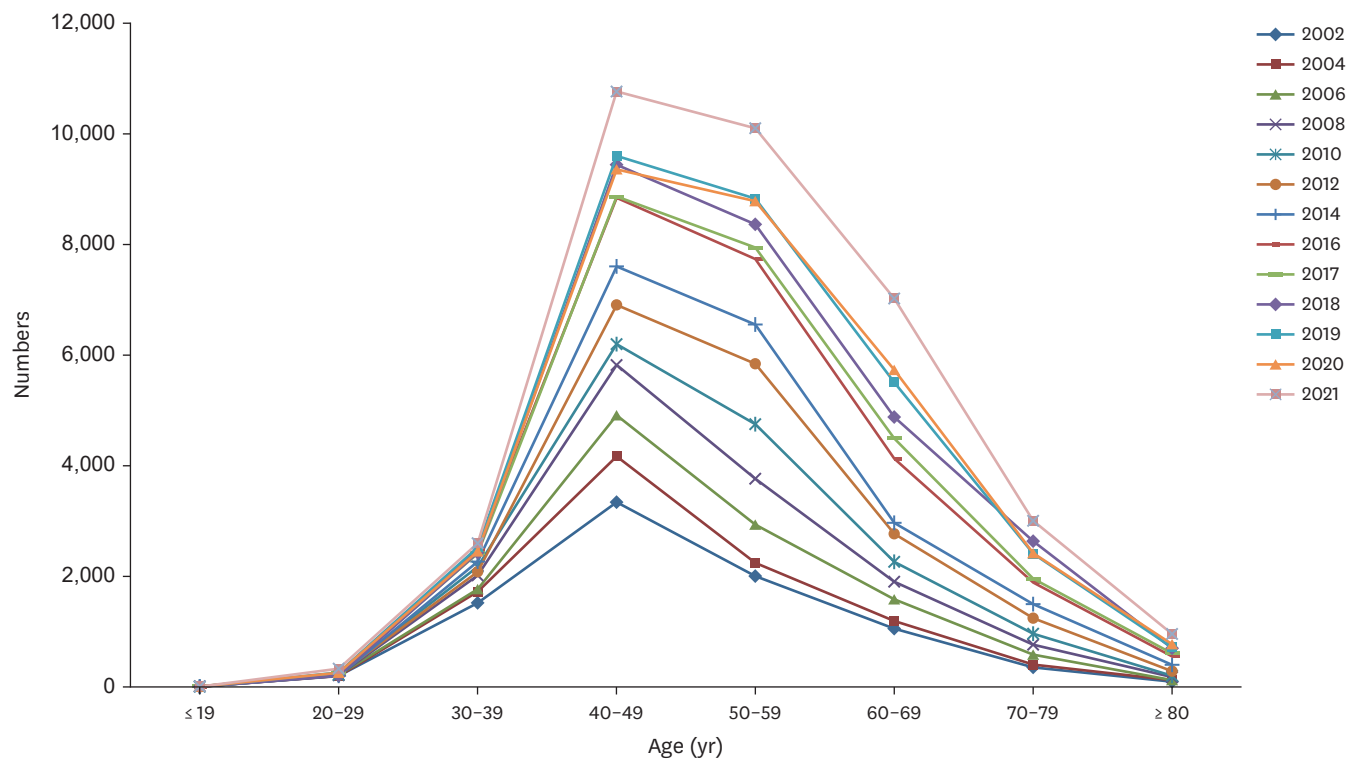


Figure 4. Age distribution of women with newly diagnosed breast cancer, Korea.

**Table 1.** Stage distribution of women with newly diagnosed breast cancer in Korea, 2021 (Korean Breast Cancer Society registry)

Stage	Patients
0	2,069 (16.6)
I	5,556 (44.4)
II	3,176 (25.3)
III	718 (5.7)
IV	106 (0.8)
Unknown	912 (7.2)
Total	12,537 (100)

Values are presented as number (%).

**Table 2.** Molecular subtypes of newly diagnosed breast cancer in Korea, 2021 (Korean Breast Cancer Society registry)

Subtype	Patients
HR+/HER2-	7,701 (69.1)
HR+/HER2+	1,189 (10.7)
HR-/HER2+	957 (8.6)
HR-/HER2-	1,292 (11.6)
Total	6,628 (100)

Values are presented as number (%).

HR+ = hormone receptor-positive; HER2- = human epidermal growth factor receptor 2-negative; HER2+ = human epidermal growth factor receptor 2-positive; HR- = hormone receptor-negative.

followed by HR-negative/HER2-negative (11.6%), HR-positive/HER2-positive (10.7%), and HR-negative/HER2-positive (8.6%) (**Table 2**).

### *Surgical and systemic treatments*

Of the 12,537 patients in the KBCS registry, 8,450 (67.4%) underwent breast-conserving surgery, while 4,012 (32.0%) received a total mastectomy. Among those who had a mastectomy, 1,553 (38.7%) also underwent breast reconstruction surgery. Concerning axillary surgery, 1,982 patients (15.8%) had an axillary lymph node dissection, and 9,032 (72.0%) patients received sentinel lymph node biopsy alone. Chemotherapy was administered to 3,689 patients (29.4%) with non-metastatic breast cancer, with 46.8% of those receiving neoadjuvant systemic therapy before surgery.

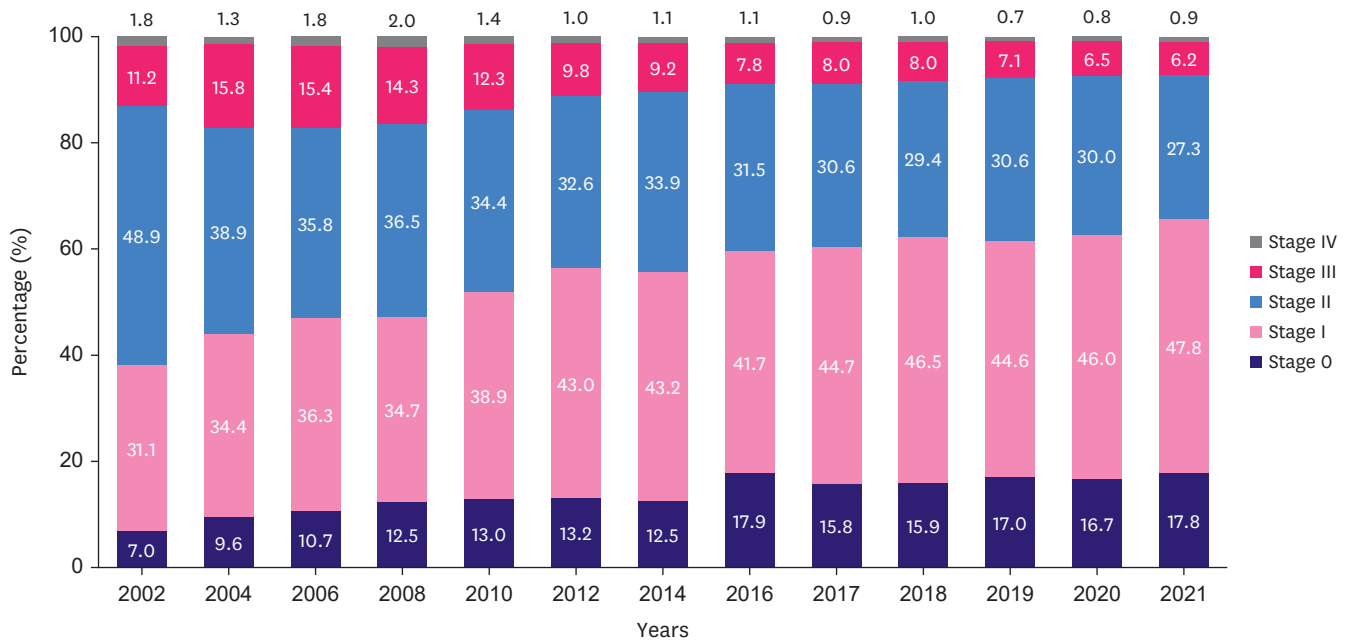
## **Changing trends of breast cancer in Korea**

### *Cancer screening rates and stage distribution during the coronavirus disease 2019 (COVID-19) pandemic*

According to data from the National Health Insurance Corporation, the breast cancer screening rate dropped by 7.5% in 2020 compared to 2019, likely due to reduced access to screening services during the COVID-19 pandemic (**Table 3**). However, in 2021, the screening rate rebounded to 65.9%, a 7.4% increase from the previous year, reflecting the shift of COVID-19 from a pandemic to an endemic situation. Remarkably, despite these fluctuations in screening rates, there was no notable impact on the distribution of breast cancer stages at the time of diagnosis. In 2020, despite the decline in screening, early-stage breast cancer (stage 0 or I) still increased to 62.7%, compared to 61.6% in 2019. In 2021, as screening rates improved, the percentage of early-stage breast cancer cases further increased to 65.7%, a 3% increase from the previous year (**Figure 5**).

**Table 3.** Breast cancer screening rate compiled by the National Health Insurance Corporation from 2014 to 2021

	2014	2015	2016	2017	2018	2019	2020	2021
Screening rate (%)	66.0	61.2	62.9	63.6	65.8	66.0	58.5	65.9



**Figure 5.** Trends in the stage distribution among women with newly diagnosed breast cancer, Korea.

#### Changes in incidence

The number of newly diagnosed breast cancer cases in Korea has exhibited a steady rise, increasing from 8,567 in 2002 to 16,772 in 2010, and further doubling to 34,628 in 2021. This marked the first time the annual number of breast cancer cases exceeded 30,000 (**Figure 1**). The CR for breast cancer in 2021 was 134.5 per 100,000 women. Invasive breast cancer had a CR of 111.6, while carcinoma *in situ* accounted for 22.9 cases per 100,000 women. Over the past 21 years, these rates have increased more than 4.4-fold and 14.3-fold, respectively (**Figure 2**). The ASR for breast cancer in 2002 was 46.1, with 43.4 for invasive cancers and 2.8 for *in situ* cases. By 2021, the ASR had increased to 132.8, with 109.9 for invasive and 22.9 for *in situ* cancers.

Between 1999 and 2021, the AAPC of breast cancer in women was 6.0%. The AAPC for *in situ* breast cancer was higher at 12.1%, compared to invasive cancer. Age-specific trends showed the highest AAPC among patients aged 60 and above at 7.1%, followed by 5.9% in those aged < 45 years, and 5.8% in those aged 45–60 years.

#### Age distribution

The median age of women with newly diagnosed breast cancer has gradually increased, exceeding 50 years in 2011 (**Figure 3**). According to the KCCR registry, the median age of women with newly diagnosed breast cancer in 2021 was 52.8 years. The age distribution has maintained an inverted V-shape pattern since 2000 (**Figure 4**), with the 40–49-year-old group consistently representing the most common age range for breast cancer diagnoses, followed by women aged 50–59, 60–69, 70–79, and 30–39 years. Since 2010, the number of patients diagnosed with breast cancer after their 50s has increased.

#### Stage distribution and biological markers

After excluding patients with author disease stage, the proportion of those diagnosed with stage 0 or I disease increased from 38.1% in 2002 to 65.6% in 2021 (**Figure 5**). Conversely, the proportion of patients with stage II or III disease decreased from 60.1% in 2002 to 33.5%

**Table 4.** Changes of the distribution of hormone receptor status (Korean Breast Cancer Society registry)

Status	2012	2014	2015	2016	2017	2018	2019	2020	2021
<b>ER</b>									
Positive	7,706 (73.0)	7,326 (74.1)	6,116 (73.7)	4,637 (75.8)	7,984 (77.5)	7,154 (76.7)	5,404 (76.7)	10,231 (73.8)	9,424 (75.2)
Negative	2,721 (25.8)	2,538 (25.7)	1,753 (21.2)	1,348 (22)	2,314 (22.5)	2,168 (23.3)	1,635 (23.3)	2,859 (20.6)	2,398 (19.1)
Unknown	124 (1.2)	17 (0.5)	423 (5.1)	131 (2.2)	Excluded	Excluded	Excluded	775 (5.6)	715 (5.7)
Total	10,551	9,881	8,292	6,116	10,298	9,346	7,039	13,865	12,537
<b>PR</b>									
Positive	6,585 (62.4)	5,407 (62.4)	5,203 (62.7)	4,014 (65.6)	6,807 (66.1)	6,067 (64.9)	4,744 (67.3)	8,752 (63.1)	8,055 (64.2)
Negative	3,837 (36.4)	3,252 (37.5)	2,666 (32.2)	1,971 (32.2)	3,436 (33.9)	4,075 (35.1)	2,282 (32.7)	4,336 (31.3)	3,755 (30.0)
Unknown	127 (1.2)	10 (0.1)	423 (5.1)	131 (2.2)	Excluded	Excluded	Excluded	777 (5.6)	727 (5.8)
Total	10,549	8,669	8,292	6,116	10,293	9,346	7,026	13,865	12,537

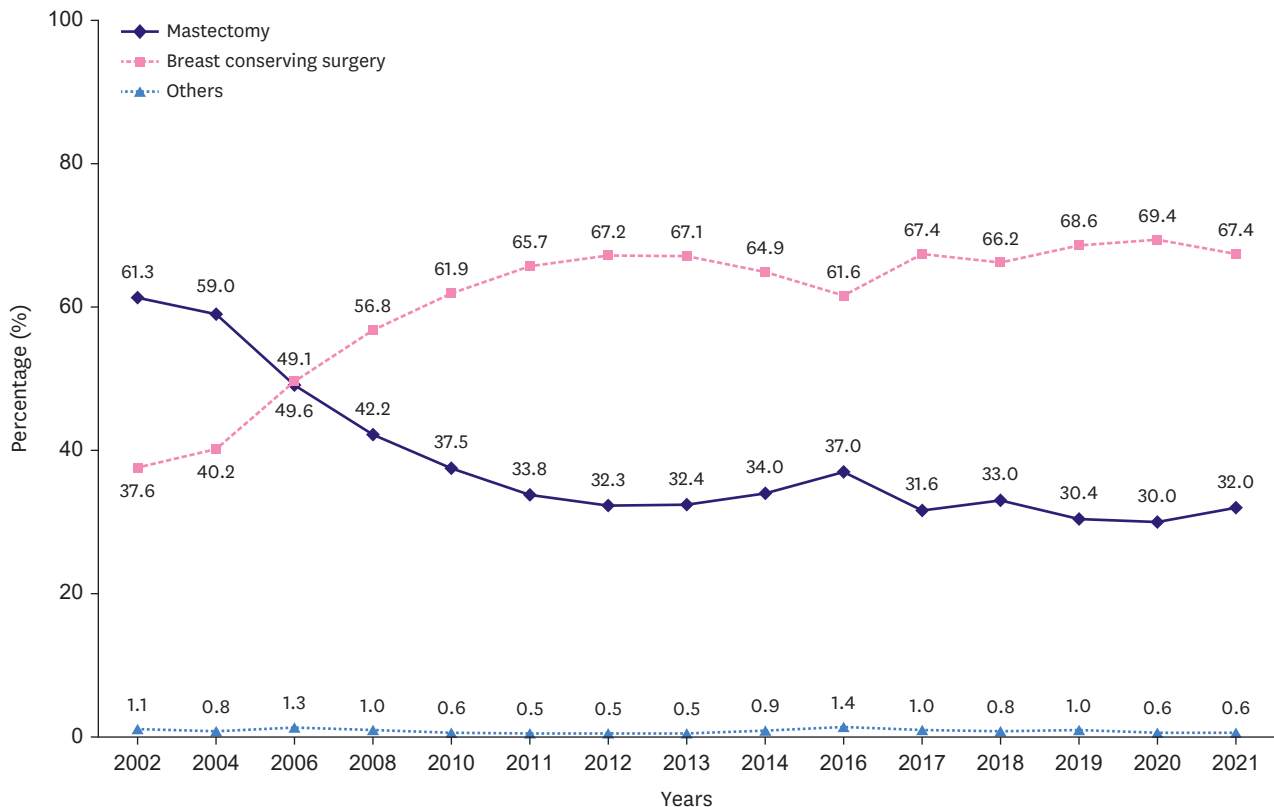
Values are presented as number (%).

ER = estrogen receptor; PR = progesterone receptor.

in 2021, reflecting a consistent increase in the incidence of early-stage breast cancer. Data from the KBCS registry from 2002 to 2021 also revealed that the distribution of HR status was similar to that observed in previous years (**Table 4**).

### Surgical patterns

According to the KBCS registry, the breast conserving surgery (BCS) and mastectomy rates in 2002 were 37.6% and 61.3%, respectively (**Figure 6**). Since then, the proportion of BCS has gradually increased, while the rate of mastectomy decreased, a trend that continued until 2012. However, the rate of BCS use had been decreased and the rate of mastectomy had been increased between 2013 and 2016. Since 2017, the proportion of patients who have undergone BCS showed increasing trends again, with 67.4% of patients in 2021. In terms of trends for axillary surgery, the proportion of sentinel lymph node biopsy has increased from 75.6% in 2011 to 81.3% in 2021.


**Figure 6.** Changes in the surgical patterns of breast cancer.

**Table 5.** Five-year relative survival rate of women with breast cancer in Korea (2001–2021)

Factors	Year of diagnosis				
	2001–2005	2006–2010	2011–2015	2016–2020	2017–2021
Age group (yr)					
< 45	89.2	91.8	93.4	94.4	94.5
45–60	90.0	92.3	93.6	94.8	94.7
≥ 60	83.9	87.7	90.3	91.5	91.6
Stage group					
Localized	-	97.8	98.6	99.0	98.9
Regional	-	89.7	91.5	92.7	92.7
Distant	-	42.3	42.5	45.3	45.2
Unknown	-	88.5	84.7	84.6	85.7

*Five-year relative survival rate*

According to the KCCR data, the 5-year relative survival rate of patients diagnosed with breast cancer between 2017 and 2021 was 93.6%, reflecting 5.9% improvement compared to the 87.7% survival rate for those diagnosed from 2001 to 2005. The highest survival rate (94.7%) was observed in the 45–60-year age group, while the lowest (91.6%) was observed in patients > 60-year group (Table 5). When categorized by stage—localized, regional, and distant stages—patients diagnosed between 2017 and 2021 had 5-year relative survival rates of 98.9%, 92.7%, and 45.2%, respectively, following SEER program classification.

**DISCUSSION**

In 2021, the annual number of patients with newly diagnosed breast cancer in Korea exceeded 30,000 for the first time. Since 2000, the incidence of breast cancer has been steadily risen, making it the most common malignancy among Korean women. Although the exact cause of this increase is difficult to determine, it may be attributed to the higher estrogen exposure owing to reproductive risk factors such as early menarche, later menopause, advanced maternal age at first birth, fewer children, and reduced breastfeeding [6]. Moreover, lifestyle changes, including high-fat diets, excess body weight, and physical inactivity, may have an impact on the rising incidence of breast cancer. Socially, growing awareness among women about the importance of regular health check-ups and participation in national cancer screening programs may have led to an increase in the detection of early-stage cancers [7].

One of the remarkable characteristic of Korean patients with breast cancer is the higher proportion of younger individuals compared to those in Western countries [8]. Regarding the age distribution of newly diagnosed patients, the most common age group for developing breast cancer among Korean women is 40–49 years, followed by 50–59 and 60–69 years. The unique inverted V-shape of the age distribution graph has remained unchanged since 2000. However, the median age of patients has steadily increased to 53.4 years in 2021. This trend may be attributed to younger women increasingly exposed to cumulative risk factors such as lower parity, reduced breastfeeding, and lifestyle changes associated with socio-environmental stress [9]. Consequently, it is anticipated that the age distribution of Korean patients may begin to resemble that of Western countries, leading to a higher median age at diagnosis.

Our data on national cancer screening rates during the COVID-19 pandemic in 2020 show a decline in breast cancer screening compared to the previous year. Consequently, the incidence of newly diagnosed breast cancer decreased in 2020. However, following the recovery of the screening rates in 2021, the incidence of breast cancer increased.

Considerably, this fluctuation did not impact the overall distribution of cancer stages at initial diagnosis. The incidence of early-stage cancer (stages 0 or I) continued to increase during the pandemic. This finding contrasts with a retrospective analysis using the National Cancer Database, where Chung et al. [10] suggested that the overall clinical stage at diagnosis was higher for COVID-tested or positive patients than for those diagnosed pre-COVID. This discrepancy may be attributed to differences in access to medical resources between countries or varying national policies on social isolation and quarantine during the pandemic. As our data lack detailed information on COVID test results, the specific impact of COVID-19 remains unclear. Further studies are needed to evaluate the effects of the COVID-19 pandemic on breast cancer diagnosis and clinical staging in Korea.

Regarding trends in surgical procedures for breast cancer, the use of BCS decreased while the mastectomy rates increased between 2013 and 2016. This shift may be attributed to the increased popularity of genetic counseling following the "Angelina Effect" and the growing use of breast magnetic resonance imaging techniques, which can detect suspicious non-mass lesions with high sensitivity [11-13]. Considerably, since 2017, the proportion of patients undergoing BCS has increased, reaching 67.4% in 2021. This trend may be associated with the rising use of neoadjuvant systemic therapy [14]. Monitoring these changing trends of BCS and mastectomy rates over time will be essential.

In terms of axillary surgery, the proportion of sentinel lymph node biopsies increased from 75.6% in 2011 to 81.3% in 2021. This rise follows the publication of several prospective clinical trials aimed at de-escalating axillary management, including the American College of Surgeons Oncology Group Z0011, Z1071, and SENTINA trials. These studies have contributed to a growing trend toward omitting axillary node dissection in patients with clinically positive lymph nodes [15,16]. Future studies with more detailed clinical data are needed to explore the impact of these trials on patients eligible for de-escalation strategies.

The 5-year relative survival rate for patients with breast cancer diagnosed between 2017 and 2021 was 93.6%, representing a 5.9% increase compared to the period from 2001 to 2005. The primary factor driving this improvement in survival rates is the higher proportion of patients diagnosed at earlier clinical stages. Data indicate that the percentage of patients diagnosed with stage 0 or I disease increased from 51.9% in 2010 to 65.6% in 2021. Contributing factors include widespread cancer screening programs, increased disease awareness, and advancements in systemic treatments. Despite the rising incidence of breast cancer in Korea, the overall mortality rate has declined. However, the poor prognosis for elderly patients and those with distant metastases remains a significant concern.

In conclusion, breast cancer remains the most common cancer among Korean women, with a steadily increasing incidence. Data from the KCCR and KBCS registries indicate that the overall survival rate for patients with breast cancer has improved, primarily due to a rise in early-stage diagnoses and advancements in treatment. As the average age of newly diagnosed patients with breast cancer in Korea is still lower than that of patients in Western countries, further investigation into alternative cancer screening methods and comprehensive strategies for younger patients is warranted.

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