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Survival feature and trend of female breast cancer: A comprehensive review of survival analysis from cancer registration data

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ABSTRACT

To better understand global patterns, chronological changes, and international comparisons of female breast cancer survival, we reviewed published data from population-based cancer registries worldwide. Using PubMed, Embase, Web of Science, SEER, and SinoMed, a comprehensive literature search was conducted for female breast cancer survival from the population-based cancer registries through 31 December 2023. Observed, relative, and net survival rates and their corresponding age-standardized survival rates since the 1990s were collected and further stratified by prognostic factors. The prognosis of female breast cancer patients was favorable, with 5-year relative survival rates above 80 % in most regions. The trend in breast cancer survival showed annual increases in most countries but was accompanied by geographical disparities. The highest age-standardized 5-year relative survival rate was identified in the USA (2010–2014) at 90.2 %, while the lowest was in India (2010–2014) at 66.1 %. Overall, North America and Oceania had the best survival, and, for Europe, survival was worst in Eastern Europe. The survival in some Asian countries was disturbing. Younger age groups had a better prognosis than those aged 75 years and over. The lowest survival rates were observed in patients with distant metastatic and triple-negative breast cancer. Worldwide, there has been a steady improvement in female breast cancer survival. However, the survival gap between developed and developing countries has remained wide over the past 30 years. Differences in age, stage at diagnosis, and molecular subtype may explain some of the disparities, providing evidence for targeted management strategies.

1. Introduction

Breast cancer begins in the breast epithelial tissue, and approximately 99 % of all cases occur in women [1]. The International Agency for Research on Cancer (IARC) reported that female breast cancer was the second most common cancer worldwide and the fourth leading cause of cancer deaths, accounting for 23.8 % of new cases and 15.4 % of deaths among women in 2022 [2]. The incidence of breast cancer exhibited significant geographical variability, ranging from 26.7 per 100,000 women in South Central Asia and Middle Africa to 100.3 per 100,000 women in Australia and New Zealand [2]. Despite an increase in incidence over time, a marked decrease in breast cancer mortality has been demonstrated in many countries, to be attributed to the growth in socio-economic conditions, the implementation of mammography screening, and the utilization of neoadjuvant therapy [3,4].

Survival serves as another crucial measure of the availability and effectiveness of healthcare services in the management of breast cancer patients. However, limited data on global features are available on population-based cancer survival. Unlike hospital-based survival, in which patients are highly pre-selected, survival from population-based

Abbreviations: IARC, International Agency for Research on Cancer; HDI, Human Development Index; ICD-10, the tenth revision of the International Classification of Diseases; ICD-O-3, the third revision of the International Classification of Diseases for Oncology; OSR, observed survival rate; RSR, relative survival rate; ICSS, International Cancer Survival Standards; HR, hormone receptor; ER, estrogen receptor; PR, progesterone receptor; HER2, human epidermal growth factor receptor 2; TNBC, triple-negative breast cancer; DCO, death certificate only.

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cancer registries collects information on all newly diagnosed cancer cases in a pre-defined region and period. They enable regional comparisons and reveal possibilities for prognostic improvement. Currently, female breast cancer has a relatively good prognosis with 5-year survival rates exceeding 90 % in the early stages [4]. While global breast cancer survival has steadily improved, the gap between low Human Development Index (HDI) countries and high-index countries remains wide [5]. Further, age at diagnosis, clinical stage, molecular subtype, and histology type are important parameters that affect breast cancer prognosis [6,7]. Thus, quantifying the magnitude of global patterns and disparities of breast cancer survival in different geographical regions and clinical characteristics is imperative for health planners to develop targeted management strategies and rationalize health resource allocation.

In the present study, to better understand global patterns, chronological changes, and international comparisons, we conducted a comprehensive review of female breast cancer survival from population-based cancer registries worldwide since the 1990s.

2. Methods

2.1. Search strategy and selection criteria

A comprehensive literature search was conducted for studies on survival in breast cancer patients, using the databases of PubMed, Embase, Web of Science, SEER, and SinoMed from inception through December 31, 2023. The search strategy included various combinations of search terms for breast cancer, survival rate, cancer registry, and population-based cancer survival study (Table S1). The literature language was limited in Chinese and English. Cancer cases were coded to the tenth revision of the International Classification of Diseases (ICD-10) or the third revision of the International Classification of Diseases for Oncology (ICD-O-3), and patients coded C50.0-C50.9 were identified as breast cancer cases.

Two researchers (DDT and ZJY) independently assessed studies for inclusion eligibility that met the following criteria: 1) survival statistics were population-based or carried out by cancer registries; 2) the subject of interest was female breast cancer patients, and the outcome of interest was survival; 3) the survival indicators, such as observed survival rate (OSR), relative survival rate (RSR), or net survival rate, were reported. We also excluded duplicate, non-original, or unavailable articles. If more than one study estimated survival for a region during the same or overlapping calendar period, we selected the latest published or largest-scale study. Conflicts in study selection were resolved by consensus.

2.2. Data extraction and statistical analysis

From each eligible article, two independent reviewers (DDT and ZJY) extracted estimates of OSR, RSR, and net survival rates. The Kaplan-Meier or life-table method was used to calculate OSR, also known as all-cause survival rate or crude survival rate in the literature. RSR is a net survival measure that represents the excess mortality from cancer after adjustment for other causes of death [8,9]. It is defined as the ratio of the observed survival of cancer patients to the expected survival of cancer-free individuals with comparable characteristics such as age, sex, and calendar period [8,9]. Similarly, the net survival rate using the Pohar Perme estimator provides unbiased estimates under the framework of relative survival [10,11]. Therefore, we presented two indicators together as RSR in this study. Considering the differences in the age structure of different populations and allowing for comparability between different regions, the age-standardized relative or net survival rate was used according to the International Cancer Survival Standards (ICSS) weights [12]. We also collected this rate in our report. In addition, the relevant information from each study was extracted, including the author, publication year, country, cancer registry, calendar period, number of patients submitted and included for analysis, age range, year at the end of follow-up, data quality indicators, and calculation methods of OSR and RSR (Table S8).

Age at diagnosis, clinical stage, and molecular subtype are major prognostic factors for breast cancer. To explore potential heterogeneity in survival, we further collected and compared survival rates in different subgroups by these factors based on those available publications. As described in most studies, age was categorized as $\leq$44, 45–54, 55–64, 65–74 and $\geq$ 75 years. The clinical stage was briefly divided into localized, regional spread, and distant metastasis. As for molecular subtypes, determination of hormone receptor (HR) status, including estrogen (ER) and progesterone receptor (PR), and human epidermal growth factor receptor 2 (HER2) status, breast cancer was classified into four main groups: HR+/HER2-, HR+/HER2+, HR-/HER2+, and HR-/HER2- (sometimes called “triple-negative”) breast cancer [7].

Given that data over the last three decades provided guidance on contemporary cancer control, this study only displayed data from the 1990s onwards. Literature management and data analysis were performed using Endnote 20 and Excel 2016.

3. Results

A total of 1671 articles were collected after the removal of duplicates. After screening the title and abstract, 236 potentially eligible articles were further examined in detail. After a review of full-text, 75 studies were included based on the pre-specified criteria. Moreover, 24 studies were identified through reviewing reference lists in retrieved articles. Finally, we included 93 articles for analysis. The study selection process is provided in Fig. 1.

3.1. Global pattern and trend

The overall 1-, 3-, 5-, and 10-year observed survival rates of female breast cancer are listed in Table 1 from population-based cancer registries in China [13–20], Thailand [14,21], Spain [22,23], France [24], the USA [25,26], and Australia [27]. From the available data, it is clear that female breast cancer progresses slowly and that patient survival has improved in each region worldwide as the calendar year goes by. The decline between 1- and 3-year OSRs for breast cancer was remarkable, especially for patients diagnosed in Khon Kaen of Thailand (1985–1992), and Cixian of China (2000–2002, 2008–2012), with the difference exceeding nearly 20 percentage points or more [13,14,21]. The 5-year survival rate was the most frequently reported, which allowed us to evaluate the time trends in the long-term survival of breast cancer patients. Among the regions selected, the one with the longest time span was Khon Kaen of Thailand with 27 years, followed by Jiashan of China, Sihui of China, Granada of Spain, and the USA with 25, 22, 22, and 21 years, respectively [14,16,20–22,25,26]. The largest increase in 5-year OSR was observed in Jiashan, with a 26.7 percentage point increase from 57.1 % in 1987–2002 to 83.8 % in 2008–2012 [14,16]. The 5-year OSR in Khon Kaen of Thailand and Sihui of China rose by 22 and 24.2 percentage points, respectively, since the 1890s to the 2010s, but the rate still fell short of 70 % [14,20,21]. Alarmingly, patients in Cixian were also desperate for enhanced healthcare, as the 5-year OSR in the area (2008–2012) was only 58 % [14]. Few figures were available for the 10-year OSR, which was in the 50–70 % range [16,23,24]. Survival statistics for a single calendar period in other countries and regions are also provided in Table S2 for reference. [14,28–59].

Table 2 demonstrates the overall 1-, 3-, 5-, and 10-year relative survival rates of female breast cancer from selected countries and regions in Asia [15,17,60–66], Europe [24,67–75], America [76,77], and Oceania [78]. The 3-year RSR for patients diagnosed at each calendar period was 10–20 percentage points lower than the 1-year RSR in Qidong of China (1988–2011) and Cali of Colombia (1995–2004), whereas the gap between the two rates was relatively narrow in the USA (1990–2019) [61,76,77]. The long-term survival of breast cancer patients has proliferated in different countries and regions. In Japan [63,64], Korea [65], Genoa of Italy [69], Finland [70,71], England [73],

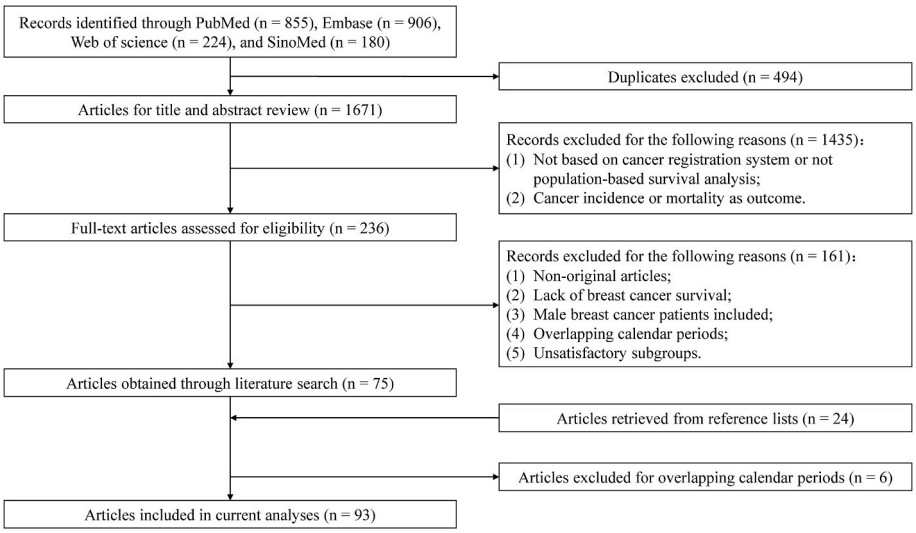

Fig. 1. Study selection process.

Table 1
Overall 1-, 3-, 5-, and 10-year observed survival rates (%) of female breast cancer in selected countries and regions, 1990–2019.

Continent	Country	Region		Period	1-year	3-year	5-year	10-year
Asia								
East	China	Hebei	Cixian [13,14]	2000–2002	63.5	44.6	33.8	–
				2008–2012	85.7	66.3	58.0	–
		Zhejiang	Taizhou [15]	2004–2008	–	–	65.2	–
				2009–2013	–	–	79.3	–
				2014–2018	–	–	84.9	–
			Jiashan [14,16]	1987–2002	83.7	67.3	57.1	48.3
				2008–2012	97.2	90.8	83.8	–
		Jiangsu	Suzhou [17]	2007–2011	–	–	69.6	–
				2012–2016	–	–	75.3	–
		Chongqi	Jiulongpo [18,19]	2008–2013	88.6	77.6	70.9	–
				2014–2016	–	–	76.9	–
		Guangdong	Sihui [20]	1987–1996	–	–	32.9	–
				1997–2006	–	–	56.8	–
				2007–2009	–	–	57.1	–
Southeast	Thailand	Khon Kaen [14,21]	1985–1992		87.4	60.2	45.4	–
			2008–2012		90.5	77.9	67.4	–
Europe								
South	Spain	Granada [22]		1990–1994	–	–	67.5	–
				1995–1999	–	–	73.7	–
				2000–2004	–	–	77.0	–
				2005–2009	–	–	80.0	–
				2010–2012	–	–	81.0	–
		Girona and Tarragona [23]		1985–1994	–	–	68.0	52.0
				1995–2004	–	–	78.0	64.0
West	France	Cote d'Or [24]		1982–1992	94.0	–	72.0	57.0
				1993–1997	96.0	–	78.0	63.0
America								
North	United States [25,26]			1998–2007	–	–	83.0	–
				2010–2019	–	–	86.0	–
Oceania								
	Australia	Western Australia [27]		1994	–	–	83.2	–
				1999	–	–	87.0	–

-No report or non-available in the original articles.

Cote d'Or of France [24,75], and the USA [76], the 5-year RSRs exceeded 80 % in the 1990s, of which Korea, Genoa of Italy, Cote d'Or of France, and the USA entered the 20th century with more than 90 %. Moreover, the prognosis of patients in the USA appeared quite favorable, with a 10-year RSR of around 80 % for those diagnosed in the early 1990s [76]. Equally promising, there was a 20.3 percentage point increase in the 5-year RSR for patients diagnosed in Taizhou of China from 70.2 % in 2004–2008 to 90.5 % in 2014–2018 [15]. Yancheng of China has experienced rapid healthcare growth as well, with the rate increasing from 78.7 % in 2012–2014 to 91.3 % in 2018–2020 [62]. Comparatively, patients in Qidong (1988–2007) and Cali (1995–2004) had a poor prognosis, with a 5-year RSR of less than 70 % [61,77]. The rate in Estonia had a greater increase from 64.4 % in 1995–1999 to 75.9 % in 2005–2009, but patients there presented a remarkably poorer prognosis than those in other European countries during the same period [72]. The survival status of breast cancer patients in other countries and regions are given in Table S3 [13,20,21,33,34,36,37,39,40,42,43,45,46,52–56,59,79–90].

To interpret long-term trends and compare disparities across countries in female breast cancer survival, the age-standardized 5-year

Table 2
Overall 1-, 3-, 5-, and 10-year relative survival rates (%) of female breast cancer in selected countries and regions, 1990–2020.

Continent	Country	Region		Period	1-year	3-year	5-year	10-year
Asia								
East	China	Zhejiang	Taizhou [15]	2004–2008	–	–	70.2	–
				2009–2013	–	–	83.8	–
				2014–2018	–	–	90.5	–
			Haining and Jiashan [60]	2003–2006	–	–	85.2	–
				2007–2010	–	–	87.9	–
		Jiangsu	Qidong [61]	1988–1992	85.8	67.9	60.3	52.9
				1993–1997	77.0	63.2	54.6	49.8
				1998–2002	82.9	68.7	63.1	60.9
				2003–2007	85.2	75.9	69.3	–
				2008–2011	90.3	81.6	–	–
			Suzhou [17]	2007–2011	–	–	77.5	–
				2012–2016	–	–	82.8	–
			Yancheng [62]	2012–2014	–	–	78.7	–
				2015–2017	–	–	90.2	–
				2018–2020	–	–	91.3	–
	Japan [63,64]			1993–1996	–	–	84.4	–
				1997–1999	–	–	85.5	–
				2002–2006	–	–	87.6	79.3
	Korea [65]			1993–1995	–	–	79.3	–
				1996–2000	–	–	83.6	–
				2001–2005	–	–	88.7	–
				2006–2010	–	–	91.2	–
				2011–2015	–	–	92.8	–
				2015–2019	–	–	93.6	–
	Kuwait [66]			2000–2004	–	–	76.1	–
				2005–2009	–	–	77.7	–
				2010–2013	–	–	82.6	–
Europe								
Central	Germany	Saarland [67,68]		1990–1992	–	–	75.7	64.9
				1993–1996	–	–	73.0	–
				1997–2000	–	–	77.1	–
				2001–2004	–	–	80.1	–
				2005–2008	–	–	84.2	–
South	Italy	Genoa [69]		1996	–	–	85.3	–
				2000	–	–	90.9	–
North	Finland [70,71]			1990–1992	–	–	81.6	–
				1993–1997	–	–	84.0	–
East	Estonia [72]			1995–1999	89.6	–	64.4	54.0
				2000–2004	91.6	–	73.5	–
				2005–2009	92.6	–	75.9	66.2
West	United Kingdom	England [73]		1996–2000	–	86.4	80.6	72.8
				2001–2003	–	88.7	83.7	–
				2004–2006	–	90.4	–	–
		Wales [73]		1996–2000	–	83.2	77.9	71.5
				2001–2003	–	86.7	82.3	–
				2004–2006	–	88.7	–	–
	Netherlands	North-Holland and Flevoland [74]		1989–1991	–	85.0	–	–
				1999–2001	–	90.0	–	–
	France	Cote d'Or [24,75]		1982–1992	96.0	–	80.0	71.0
				1993–1997	98.0	–	85.0	76.0
				1998–2003	98.7	–	89.3	–
				2004–2009	98.3	–	92.3	–
America								
North	United States [76]			1990–1992	97.3	91.3	86.2	79.8
				1993–1995	97.3	91.2	86.5	79.8
				1996–1998	97.5	92.2	88.4	82.1
				1999–2001	97.6	93.2	89.6	84.0
				2002–2004	97.8	93.6	90.2	84.8
				2005–2007	97.9	94.1	91.1	85.9
				2008–2012	97.9	94.2	91.3	–
				2013–2019	98.0	94.8	92.2	–
South	Colombia	Cali [77]		1995–1999	87.0	71.0	62.0	51.0
				2000–2004	89.0	77.0	68.0	–
Oceania								
	New Zealand [78]			2000–2005	96.3	–	83.7	75.6
				2006–2010	97.2	–	86.6	79.7

-No report or non-available in the original article.

relative survival rates are presented in Figs. 2 and 3 [5,91–99]. The last three decades for most countries worldwide were divided into five calendar periods: 1990–1994, 1995–1999, 2000–2004, 2005–2009, and 2010–2014. During these five periods, the countries or regions observed with the highest age-standardized 5-year RSR were Cuba (84.0 %, 1990–1994), Australia (84.6 %, 1995–1999), the USA (88.9 %, 2000–2004), Cyprus (90.6 %, 2005–2009), and the USA (90.2 %, 2010–2014), respectively; and those with the lowest were Slovakia (57.9 %, 1990–1994), India (48.1 %, 1995–1999), Eastern Cape of South Africa (37.9 %, 2000–2004), India (59.1 %, 2005–2009), and India

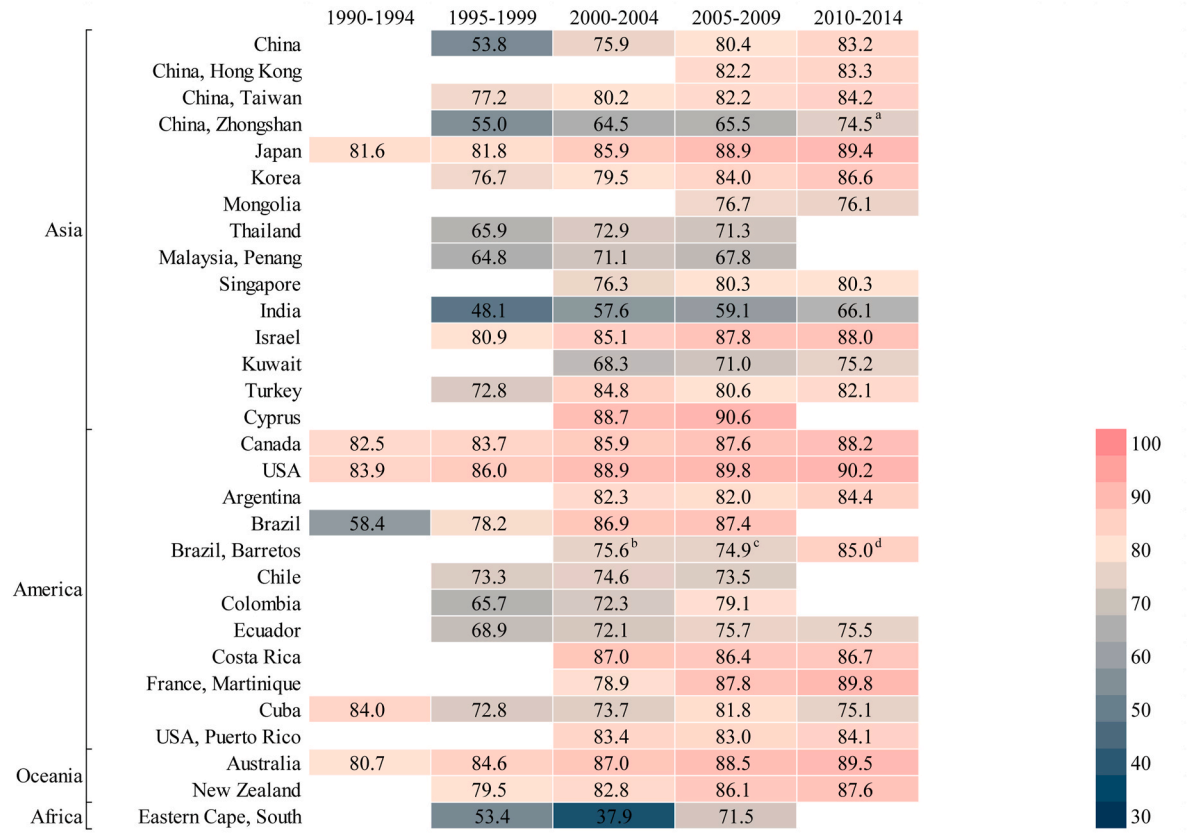

Fig. 2. Age-standardized 5-year relative survival rates (%) of female breast cancer in selected countries and regions from Asia, America, Oceania, and Africa, 1990–2018. [a] China, zhongshan, 2010–2013; [b] Brazil, Barretos, 2000–2005; [c] Brazil, Barretos, 2006–2011; [d] Brazil, Barretos, 2012–2018.

(66.1 %, 2010–2014), respectively [5,91,92]. Throughout these thirty years, the majority of countries have made impressive gains in breast cancer survival, with the survival rate of patients reaching 80 % in the latest calendar year available [5]. The greatest improvement in age-standardized 5-year RSR between 1990 and 2014 was recorded in Czech Republic, with an increase of 18.5 percentage points from 62.9 % to 81.4 %, followed by Slovakia, Slovenia, England, the UK, Portugal, Estonia, and Wales, all increasing by more than 15 percentage points [5, 91]. However, there were some countries where the rates fluctuated or even declined, such as Mongolia, Cuba, Costa Rica, and the Russian Federation [5,91,92]. In addition, in terms of the overall situation in each continent, patients in Oceania and North America had the best prognosis, while those in Asia suffered a relatively poor survival status [5]. In Europe, patients in Eastern Europe survived at a disconcerting rate, compared to other parts of Europe, requiring greater investment in healthcare funding and facilities [5,96,97]. If interested, information about age-standardized 5-year RSRs for other regions can be viewed in Table S4 [5,14,33,79,83,92,100,101].

3.2. Subgroup analysis of survival rate

Table S5 displays the age-specific 5-year relative survival rates of female breast cancer in China [33,61], Japan [49], Europe [96,102], North America [76,102], and Australia [102]. Patients aged 75 years and older typically had the worst prognosis. Disparities in survival between the other age groups (≤44, 45–54, 55–64, and 65–74 years) were narrowed, with the survival rate for patients in these groups rising above 80 % in most countries. In Europe and Canada, survival generally peaked at 45–54 years, in the USA at 65–74 years, and in Australia at 55–64 years.

The 5-year relative survival rates of female breast cancer stratified by clinical stage are given in Table S6 [63,64,66,67,72,76,89,100,103]. Localized breast cancer presented the greatest prognosis, with 5-year RSRs above 90 % for each calendar period across countries. When distant sites were already involved at diagnosis, the survival of patients was discouraging, hovering around or below 40 %. Regardless of stage, the 5-year RSRs steadily increased over time. Interestingly, the improvement in survival for breast cancer with regional spread was most pronounced, presumably due to medical advances that have effectively impeded the progression of the disease.

HR positivity was associated with a better prognosis, and the HR+/HER2-subtype showed better survival than other subtypes, followed by HR+/HER2+. Patients with TNBC were characterized by the lowest 5-year RSRs, which declined by over 10 percentage points compared to patients with HR+/HER2-. Details are shown in Table S7 [76,88,104,105].

4. Discussion

In this study, we comprehensively collected 1- to 10-year survival rates from population-based cancer registries over the past 30 years. The results demonstrated that the prognosis for female breast cancer patients is favorable and that regional disparities in survival are decreasing over time. However, the survival gap between developed and less developed regions remained wide. For example, in the 20th century, compared with an overall 5-year relative survival rate of over 90 % in the USA, the rates for patients in some regions, such as Cixian, Qidong, Fujian, and Sihui in China, Iran, Estonia, and Cali in Colombia, were below 80 % and not even up to the level of the USA in the last century. We also investigated survival disparities by age and stage at diagnosis, as well as by molecular subtype, all of which are important factors that affect treatment protocols and prognosis for breast cancer patients.

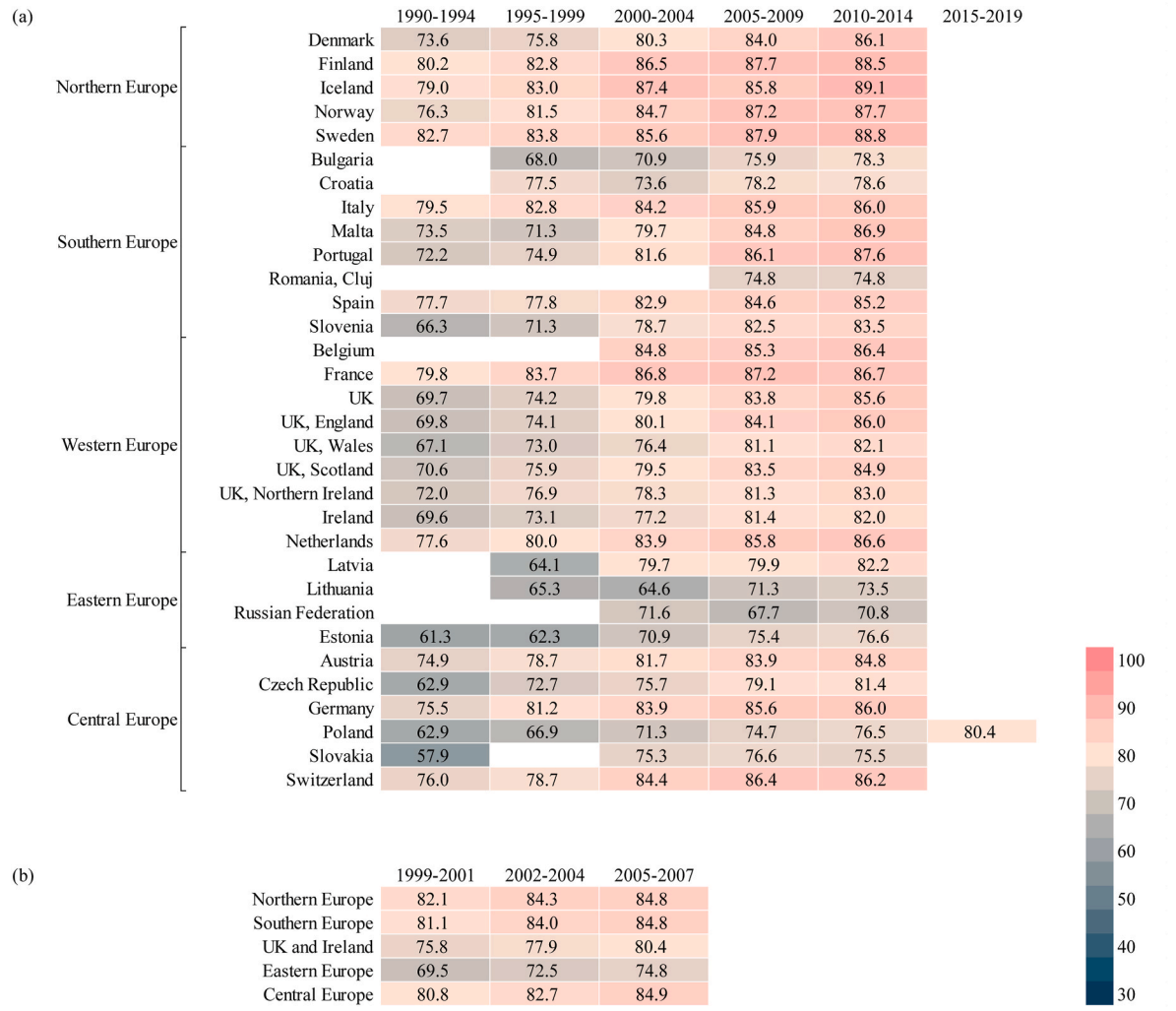

Fig. 3. Age-standardized 5-year relative survival rates (%) of female breast cancer in (a) selected countries and regions from Europe, 1990–2019, and (b) five divisions of Europe, 1999–2007.

Compared with highly lethal cancers such as lung and liver cancers, the prognosis for female breast cancer was much better; for example, 10-year relative survival rates for USA patients exceeded 80 % [76,106,107]. In line with the growth trend in survival, Siegel reported a 43 % steep decline in mortality for female breast cancer in the USA since 1989 [4]. The 5-year mortality rate for patients diagnosed with early-stage invasive breast cancer in England declined from 14.4 % in 1993–1999 to 4.9 % in 2010–2015 [3]. This change could be largely attributed to reforms in the healthcare system and advances in treatment [108–112]. Previous epidemiological studies highlighted the efficacy of screening mammography in reducing breast cancer mortality, particularly among women aged 50 and older [108–110]. Western developed countries promoted breast cancer screening in the 1980s and issued guidelines for screening with mammography as their primary measure which was available for free or covered by medical insurance. This program gained global recognition, and other countries such as Australia and Israel subsequently carried out nationwide breast cancer screening in the 1990s [113,114]. However, China progressively introduced a breast cancer screening program among women in 2008, and the following year it launched a nationwide healthcare system reform to provide universal medical insurance for all citizens [115,116]. Likewise, participation in screening varies with socioeconomic status and health awareness. In 2019, 67.5 % of women aged 40 and older and 71.6 % of women aged 50 and older in the USA declared having received a mammogram within the past two years [117]. The screening uptake rates in some European countries even went beyond 80 % of the target population, while Asian countries often offered opportunistic screening which led to very low uptake rates [114,118]. The above reasonably explained the disparities in female breast cancer survival between developed and developing countries.

While “early detection and early diagnosis” have been achieved for most breast cancer cases, overall improvements in treatment are the key to improving survival in all age groups [111,112]. In addition to high-quality surgery, new anticancer drugs, such as anthracyclines, paclitaxel, trastuzumab, and aromatase inhibitors, are being developed. Adjuvant chemotherapy, endocrine therapy, targeted therapy, immunotherapy, and neoadjuvant chemotherapy are also being refined. Today, breast cancer treatment strategies are increasingly focused on the design and implementation of personalized treatment plans based on the patient’s actual clinical needs. These efforts are expected to reduce tumor staging, increase the success rate of breast-conserving surgery, provide drug sensitivity information to guide subsequent intensive adjuvant therapy, and ultimately improve patient prognosis.

Age disparities in female breast cancer survival were also summarized in this study. The worst prognosis was shown among patients aged 75 years and over. Elderly patients usually progress to advanced stages when seeking treatment due to limited medical knowledge and family financial pressure [119,120]. Unlike young and middle-aged patients,

they are typically of poor physical quality with comorbidities such as cardiovascular disease and osteoporosis which preclude radical surgery and systemic adjuvant therapy [120]. Moreover, adverse drug reactions and taking too many medications during treatment contribute to poor adherence in elderly patients. Given the significant population aging worldwide, it is a global priority to enhance publicity and education on breast cancer prevention and treatment. It also needs to establish a scientific concept of anti-cancer and develop guidelines for the treatment of elder breast cancer.

Breast cancer is a heterogeneous disease where prognosis and treatment depend largely on stage at diagnosis and molecular subtype, with distant metastatic and triple-negative breast cancer associated with the poorest survival. The stage distribution of breast cancer at diagnosis varied considerably between countries and regions, with high proportions of distant metastasis observed in sub-Saharan Africa, Central and South America, and Central and West Asia, but low proportions observed in North America, Europe, and Oceania [121]. This provided an alternative possible explanation for the geographic differences. TNBC mainly occurs in premenopausal women under 40 years old, accounting for about 15%–20 % of breast cancer cases [122]. It is highly aggressive, and approximately 46 % of patients develop distant metastases, generally involving the lungs and brain [123]. Because of the negative expression of ER, PR, and HER2, TNBC is insensitive to endocrine therapy or targeted therapy, and chemotherapy is still considered the main systemic treatment for it [124]. However, conventional postoperative adjuvant radiotherapy has poor efficacy, and residual metastatic lesions can trigger tumor recurrence. Therefore, the worst prognosis for patients under 45 years old in British Columbia and Manitoba of Canada (1995–1999), and the USA (1990–2001) was likely due to the high proportion of TNBC.

Population-based cancer registries routinely monitor cancer incidence, mortality, and survival, which is becoming increasingly important for the better evaluation and design of cancer control strategies. With the establishment of cancer registries around the world, several points must be taken into account when comparing results between countries and over time. Firstly, most cancer cases are registered by a single registry or a combination of several registries within a country [5]. Thus, the coverage may not include 100 % of cases, leading to an inaccurate representation of national survival. Secondly, there are variations in the consistency of data processing. In some studies, participants were restricted to adults aged 15 years and older, and cases with a death certificate only (DCO) or detected solely at autopsy were excluded for statistical analysis. The extent of the loss of follow-up also affects the results. Third, cancer registries do not routinely collect important clinical data on cancer patients, including information on clinical stage, hormone receptor status, histology type, comorbidity, and other possible determinants of survival, requiring further improvement in the quality and completeness of their data. Hence, the interpretation of temporal trends and geographic comparisons in survival can be challenging and cautious, as they require that the quality of data from cancer registries be comparable and the methods used to be uniform and standardized.

In conclusion, we have summarized the 1- to 10-year observed, relative, and net survival rates for female breast cancer worldwide. An increasing trend in survival over the past decades was observed in most regions, although significant survival disparities existed between different regions. Our results indicate that age at diagnosis, clinical stage, and molecular subtype are also critical to patient prognosis. Therefore, additional health resources and services should be devoted to breast cancer screening and early diagnosis, especially in low- and middle-income countries or regions. At the same time, there is an urgent task to raise public health awareness, develop treatment guidelines for elder patients, and explore treatment strategies for triple-negative breast cancer.

CRediT authorship contribution statement

Dan-Dan Tang: Writing – review & editing, Writing – original draft, Visualization, Project administration, Investigation, Formal analysis, Data curation. **Zhuo-Jun Ye:** Writing – review & editing, Visualization, Investigation, Formal analysis, Data curation. **Wan-Wan Liu:** Writing – review & editing, Resources, Investigation. **Jing Wu:** Writing – review & editing, Resources, Investigation. **Jing-Yu Tan:** Writing – review & editing, Resources, Investigation. **Yan Zhang:** Writing – review & editing, Resources, Investigation. **Qun Xu:** Writing – review & editing, Resources, Project administration, Investigation. **Yong-Bing Xiang:** Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Funding acquisition, Formal analysis, Conceptualization.

Ethical approval and consent to participate

Not applicable.

Availability of data and materials

Not applicable.

Consent for publication

Not applicable.

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Declaration of competing interest

All authors declared that there are no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.breast.2024.103862.

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