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The incidence rate of female breast cancer in Saudi Arabia: an observational descriptive epidemiological analysis of data from Saudi Cancer Registry 2001–2008

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Background: This study presents descriptive epidemiological data related to breast cancer cases diagnosed from 2001 to 2008 among Saudi women, including the frequency and percentage of cases, the crude incidence rate (CIR), and the age-standardized incidence rate (ASIR), adjusted by the region and year of diagnosis.

Methods: This is a retrospective descriptive epidemiological study of all Saudi female breast cancer cases from 2001 to 2008. The statistical analyses were conducted using descriptive statistics, a linear regression model, and analysis of variance with the Statistical Package for the Social Sciences version 20.0.

Results: A total of 6,922 female breast cancer cases were recorded in the Saudi Cancer Registry from 2001 to 2008. The highest overall percentages (38.6% and 31.2%) of female breast cancer cases were documented in women who were 30–44 and 45–59 years of age, respectively. The eastern region of Saudi Arabia had the highest overall ASIR, at 26.6 per 100,000 women, followed by Riyadh at 20.5 and Makkah at 19.4. Jazan, Baha, and Asir had the lowest average ASIRs, at 4.8, 6.1, and 7.3 per 100,000 women, respectively. The region of Jouf (24.2%; CIR 11.2, ASIR 17.2) had the highest changes in CIR and ASIR from 2001 to 2008. While Qassim, Jazan, and Tabuk recorded down-trending rates with negative values.

Conclusion: There was a significant increase in the CIRs and ASIRs for female breast cancer between 2001 and 2008. The majority of breast cancer cases occurred among younger women. The region of Jouf had the greatest significant differences of CIR and ASIR during 2001 to 2008. Jazan, Baha, and Najran had the lowest average CIRs and ASIRs of female breast cancer, whereas the linear trend upward is a concern in certain regions, such as the eastern region, Makkah, and Riyadh. However, further analytical epidemiological research is needed to identify the potential risk factors involved in the increase in the prevalence of breast cancer among Saudi women.

Keywords: epidemiology, breast cancer, morbidity measure, public health, cancer epidemiology

Introduction

Breast cancer is not only a significant problem in Saudi Arabia but is also considered to be one of the most common causes of cancer-related mortality worldwide. Thousands of women throughout the world have been clinically diagnosed with breast cancer.[1–4] In addition, breast cancer has become a significant problem in both developed and developing countries.[5–8] It is estimated that more than one million new cases of breast cancer are diagnosed annually.[9]

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In Saudi Arabia, the International Agency for Research on Cancer estimated that the age-standardized incidence rate (ASIR) for breast cancer was 22.4 per 100,000 women in 2008, and the age-standardized mortality rate was 10.4 per 100,000 women.[10] Furthermore, in 2011, the registry of King Faisal Specialist Hospital and Research Centre reported that the number of breast cancer cases has increased considerably, especially among the younger age group.[6] Despite the lower crude incidence rate (CIR) of female breast cancer in Saudi Arabia compared with other developed countries, the Saudi Cancer Registry (SCR) reported that cancer of the female breast was the most common cancer among Saudi woman during a 14-year period (1994–2008).

This is the first epidemiological observational descriptive study of female breast cancer in Saudi Arabia. Despite insufficient information regarding female breast cancer in Saudi Arabia, with the exception of the SCR reports, we attempt to study the real situation of female breast cancer in different regions of Saudi Arabia during 2001 to 2008. Therefore, we perform the first step in epidemiologic study of disease, including time, place, and characteristics of persons.[11] The main aims of this study were to describe the burden of breast cancer among Saudi women during an 8-year period (2001–2008). In addition, this study provides a summary of the regional patterns and trends, related to the CIR and the ASIR, of breast cancer cases among Saudi women.

Materials and methods

We conducted a retrospective descriptive epidemiological study of all Saudi female breast cancer cases diagnosed between January 2001 and December 2008. The data regarding cancer in Saudi Arabia are publicly available and easily accessible. This study was made possible by the SCR, which is a population-based registry established in 1994 through the Ministry of Health in Saudi Arabia. The latest report of the SCR was published in 2008, and no additional reports were published until 2013.

Since 2001, the SCR has provided reports on the pattern of cancer in Saudi Arabia, with a primary objective of defining the population-based incidence of the disease. On the basis of these data, there are currently comprehensive reports for 13 administrative regions from 2001 to 2008 that discuss the frequency with the percentage of cases, the CIR, and the ASIR, adjusted by the provinces of Saudi Arabia and years of diagnosis. This study was conducted using these reports to critically gather all of the information from the SCR with the aim of presenting the descriptive epidemiology of female breast cancer in Saudi Arabia.

For data analysis, we used the Statistical Package for the Social Sciences version 20.0 (IBM Corporation, Armonk, NY, USA). The descriptive analysis of the epidemiological data was performed by calculating the overall percentage, the CIR, and the ASIR adjusted by the age group, region, and year of diagnosis. The percentage was calculated by adding the number of cases of female breast cancer and then dividing that number by the total number of female cancer cases. Furthermore, an analysis of variance test was performed to determine any significant differences among the regions and years of diagnosis.[12] In addition, the linear regression model that investigates the strength of the association between independent variables and an outcome was applied to predict the annual the annual CIR and ASIR for breast cancer among Saudi women.[13]

The overall age-standardized rates per 100,000 women were calculated for all of the SCR reports based on a (Segi) standard for World populations who have an intermediate-age. This is a particularly important rate when making comparisons between different populations with respect to the age structure.[14,15]

Results

A total of 6,922 female breast cancer cases were diagnosed and recorded in the SCR between January 2001 and December 2008. The number of women with breast cancer increased steadily from 2001 to 2006. On the basis of the number of cases of breast cancer and their percentages, the rate appears to be increasing. For example, in Figure 1A and B, it can been seen that there were 545 cases in 2001 (19.9%; 95% confidence interval [CI], 15.1%–24.7%). This figure rose to 614 by 2002, representing an increase of 1.2%. By 2007, there were 1,239 cases reported, corresponding to a 6.1% increase; this was the highest figure reported by the SCR. Interestingly, the figure dropped to 1,152 cases in 2008, representing a decline of 1%.

The distribution of female breast cancer cases by age groups from 2001 to 2008 was calculated from the SCR. The overall number of cases and percentages shows the age groups most and least affected by breast cancer in Saudi Arabia during the 2001 to 2008 (Table 1; Figure 1C and D). The groups reported correspond to ages 15–29, 30–44, 45–59, 60–74, and older than 75 years. According to the overall numbers and percentages, the age groups that were least affected by breast cancer were women older than 75 years, at 10.2%, followed by

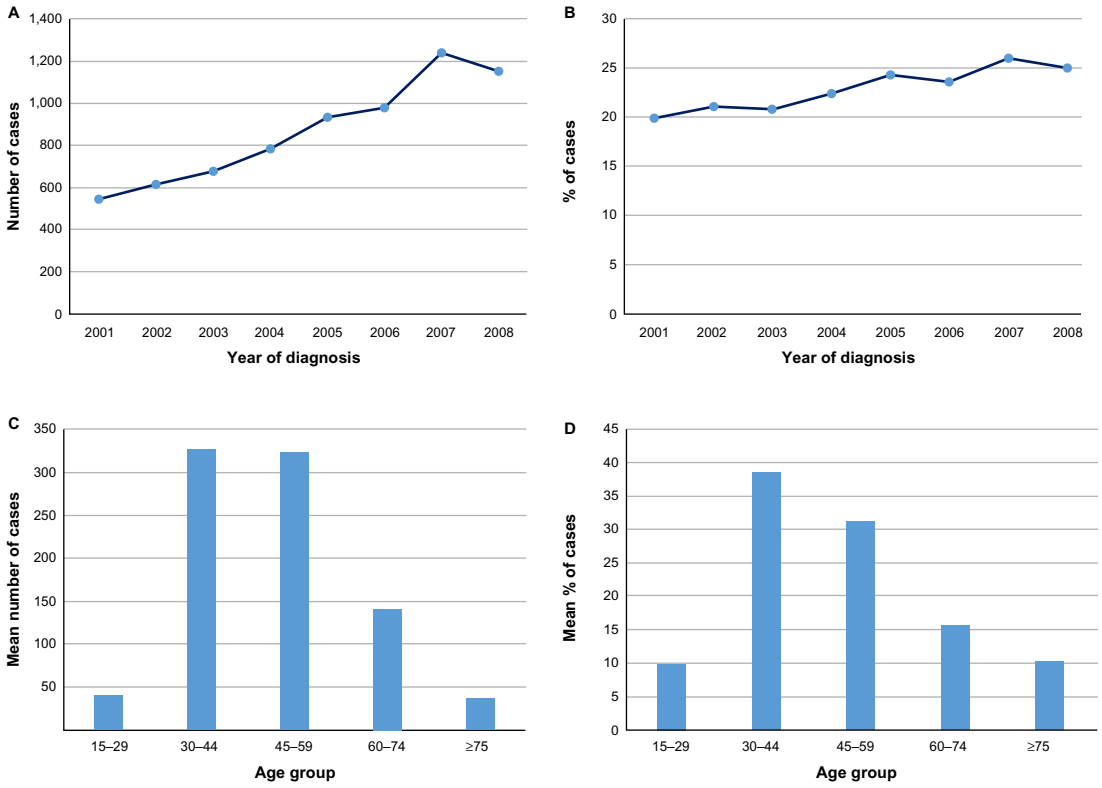

Figure 1 (**A** and **B**) Number and percentage of female breast cancer cases in Saudi Arabia from 2001 to 2008. (**C** and **D**) Overall number and percentage of female breast cancer cases distribution by age group in Saudi Arabia from 2001 to 2008.

those within the range of 15–29 years, at 10%. Alternatively, the group of younger Saudi women, those aged 30–44 years, recorded the highest overall number and percentage, with 327 cases representing 38.6% of the total number of female breast cancer cases, followed by women aged 45–59 years, with 323 cases representing 31.2%. These figures suggest that most of the female breast cancer cases in developing countries occur in women younger than 50 years.[5–8]

The CIRs of female breast cancer adjusted by year of diagnosis from 2001 to 2008 indicate a steady increase between 2001 and 2006. According to Table 2 and Figure 2A, a CIR of 6.8 per 100,000 women (95% CI, 4.61–8.99 per 100,000 women) was estimated in 2001, and a CIR of 11.4 per 100,000 women (95% CI, 7.9–15.7 per 100,000 women) was estimated in 2006. In 2007, the CIR of 14.3 per 100,000 women (95% CI, 11.1–17.5 per 100,000 women) was significantly higher compared with the other years [$F(7, 96) = 3.066$; $P < 0.001$]. However, this figure dropped by 1.4 points in 2008. On the basis of the linear regression trend, this result was statistically significant [$F(1, 102) = 23.328$; $P < 0.001$].

Table 1 Female breast cancer distribution by age group in Saudi Arabia from 2001 to 2008

Year	Age group													
	0–14		15–29		30–44		45–59		60–74		≥75		Total	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
2001	0	0	22	7.1	222	36.2	181	27.2	91	13.7	29	10.2	545	19.9
2002	0	0	26	8	246	38.9	216	28.3	95	14.1	31	10	614	21.1
2003	0	0	33	9.5	246	33.8	257	29.2	117	14.7	23	8.5	676	20.8
2004	0	0	38	10.5	305	38.1	290	31.7	116	13.5	34	11.7	783	22.4
2005	0	0	36	9	367	41.4	341	32.5	150	16.8	38	10.4	932	24.3
2006	0	0	45	11.5	364	38.4	374	33.3	159	15.3	39	9.7	981	23.6
2007	0	0	58	11.6	449	41.6	471	33.9	220	20	41	9.1	1,239	26
2008	0	0	56	12.5	415	40.2	453	33.5	176	16.3	52	11.8	1,152	25
Average	0	0	39.3	10	326	38.6	405	31.2	141	15.6	36	10.2	865	22.9

Table 2 Confidence interval for percentage, crude incidence rate, and age-standardized incidence rate of female breast cancer cases in Saudi Arabia from 2001 to 2008

Year	Percentage			Crude incidence rate per 100,000			Age-standardized incidence rate per 100,000		
	%	95% CI, lower	95% CI, upper	Crude incidence rate	95% CI, lower	95% CI, upper	Age-standardized incidence rate	95% CI, lower	95% CI, upper
2001	19.9	15.1	24.7	6.8	4.61	8.99	11.8	7.9	15.7
2002	21.1	17.8	24.4	7.9	6.3	9.5	12.6	9.2	16
2003	20.8	16.9	24.7	8.4	6.3	10.5	13.9	9.9	17.9
2004	22.4	18.4	26.4	9.5	7.3	11.7	15.4	11.8	19
2005	24.3	18.7	29.9	11	7.9	14.1	18	12.7	23.3
2006	23.6	19.6	27.6	11.4	8.6	14.2	18.1	13.9	22.3
2007	26	22.6	29.4	14.3	11.1	17.5	21.6	16.8	26.4
2008	25	21.2	28.8	12.9	10.2	15.6	19.2	14.8	23.6
Overall	22.9	18.8	27.0	10.3	7.8	12.8	16.3	12.1	20.5

Abbreviation: CI, confidence interval.

Therefore, the equation for a straight line to predict the annual CIR of female breast cancer in Saudi Arabia is 4.28 + (0.76 × years), and the incidence of breast cancer increased by a predicted average of 0.76 per 100,000 Saudi women per year. The correlation coefficient (R) for the CIR is 0.65, which indicates a moderate correlation. The coefficient of determination R^2=0.42, which means that the explanatory variable (years) explains 42% of the variability of the dependent variable (CIR).

The overall CIR of female breast cancer, adjusted by region from 2001 to 2008, per 100,000 women was estimated from the SCR, as shown in Table 3 and Figure 2B. The eastern region of Saudi Arabia had the highest overall CIR for female breast cancer, at 15.4 per 100,000 women (95% CI, 12.8–17.9

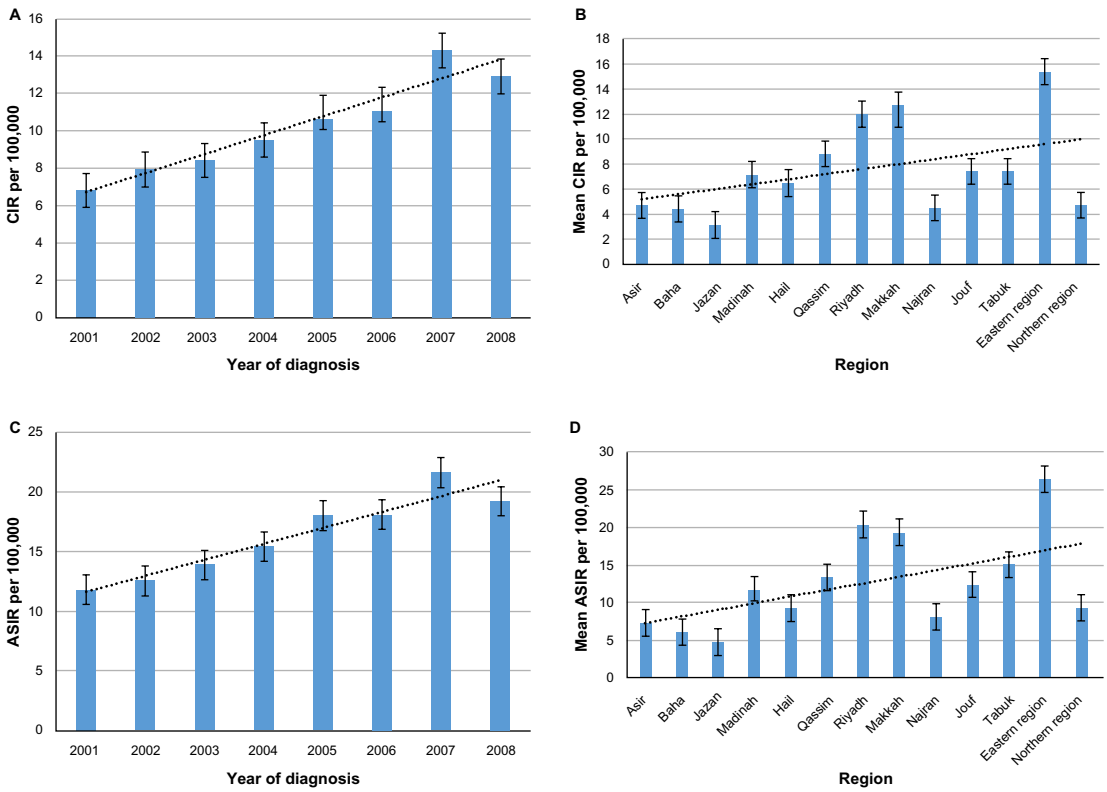

Figure 2 (**A**) Crude incidence rate (CIR) of female breast cancer cases in Saudi Arabia from 2001 to 2008. (**B**) Overall crude incidence rate of female breast cancer cases in the regions of Saudi Arabia from 2001 to 2008. (**C**) Age-standardized incidence rate (ASIR) of female breast cancer cases in Saudi Arabia from 2001 to 2008. (**D**) Overall age-standardized incidence rate of female breast cancer cases in the regions of Saudi Arabia from 2001 to 2008.

Table 3 Confidence interval for overall percentage, crude incidence rate, and age-standardized incidence rate of female breast cancer cases in the regions of Saudi Arabia from 2001 to 2008

Regions	Overall percentage			Overall crude incidence rate			Overall age-standardized incidence rate		
	%	95% CI, lower	95% CI, upper	Crude incidence rate	95% CI, lower	95% CI, upper	Age-standardized incidence rate	95% CI, lower	95% CI, upper
Asir	13.5	11.7	15.2	4.7	3.6	5.8	7.3	6.0	8.7
Baha	14.7	10.2	19.1	4.4	2.0	6.8	6.1	2.7	9.5
Jazan	14.1	9.0	19.1	3.1	1.9	4.4	4.8	2.8	6.8
Madinah	19.3	16.4	22.2	7.2	4.8	9.5	11.8	9.2	14.3
Hail	20.0	14.3	25.6	6.5	3.8	9.2	9.3	6.0	12.7
Qassim	25.2	21.8	28.5	8.8	7.1	10.5	13.4	11.7	15.1
Riyadh	21.5	19.4	23.7	12.0	9.7	14.2	20.5	17.7	23.3
Makkah	26.1	23.9	28.3	12.7	9.4	16.1	19.4	15.4	23.4
Najran	14.9	9.6	20.2	4.5	2.5	6.5	8.1	4.5	11.7
Jouf	22.0	15.8	28.2	7.4	4.4	10.4	12.4	7.5	17.2
Tabuk	19.7	16.6	22.9	7.4	5.2	9.6	15.1	12.1	18.2
Eastern region	29.0	26.8	31.1	15.4	12.8	17.9	26.6	23.2	30.0
Northern region	13.5	6.4	20.7	4.8	2.6	6.9	9.4	5.2	13.5

Abbreviation: CI, confidence interval.

per 100,000 women), followed by Makkah, at 12.7 per 100,000 women (95% CI, 9.4–16.1 per 100,000 women), and Riyadh, at 12.0 per 100,000 women (95% CI, 9.7–14.2 per 100,000 women). These findings are consistent with those reported by Ibrahim et al, demonstrating that, on average, the eastern regions of Saudi Arabia had the highest numbers of cases of breast cancer between 1999 and 2003.[16] However, the analysis of variance test revealed that the incidence of breast cancer was significantly higher for these regions compared with other parts of Saudi Arabia [$F(12, 91) = 13.852$; $P<0.001$]. Furthermore, Jazan (95% CI, 1.9–4.4 per 100,000 women), Baha (95% CI, 2.0–6.8 per 100,000 women), and Najran (95% CI, 2.5–6.5 per 100,000 women) had the lowest average CIRs for breast cancer among Saudi women at 3.1, 4.4, and 4.5 per 100,000 women, respectively.

The world ASIR of female breast cancer per 100,000 women, adjusted for the region and the year of diagnosis, suggests a similar trend to that seen for the CIR from 2001 to 2008 (Figure 2C and D). There was an increase in the number of cases of female breast cancer diagnosed between 2001 and 2008, with the highest ASIR of 21.6 per 100,000 women reported in 2007 (95% CI, 16.8–26.4 per 100,000 women), followed by a slight decrease in the ASIR to 19.2 per 100,000 women in 2008 (95% CI, 14.8–23.6 per 100,000 women), according to reports released by the SCR. In addition, the results of the linear regression model were also statistically significant [$F(1,102) = 10.341$; $P<0.001$]. Therefore, the equation for the straight line to predict the annual ASIR of female breast cancer in Saudi Arabia is $8.80 + (0.90 \times \text{years})$. The ($R$) for the ASIR is 0.55, which indicates a moderate correlation. The coefficient of determination $R^2=0.30$, which means that the explanatory variable (years) explains 30% of the variability of the dependent variable (ASIR).

Similarly, the eastern part of Saudi Arabia had the highest mean ASIR, at 26.6 per 100,000 women (95% CI, 23.2–30.0 per 100,000 women), followed by Riyadh at 20.5 per 100,000 women (95% CI, 17.7–23.3 per 100,000 women) and Makkah at 19.4 per 100,000 women (95% CI, 15.4–23.4 per 100,000 women), and the analysis of variance was statistically significant for these regions compared with other provinces of Saudi Arabia [$F(12, 91) = 21.966$; $P<0.001$]. Jazan (95% CI, 2.8–6.8 per 100,000 women) and Baha (95% CI, 2.7–9.5 per 100,000 women) had the lowest mean ASIRs, at 4.8 and 6.1 per 100,000 women, respectively.

The differences in the CIR and ASIR between 2001 and 2008 were calculated from the data in the SCR to investigate the burden of female breast cancer among Saudi women in different regions (Table 4). The greatest changes in percentages were observed in the regions of Jouf (24.2%; 11.2 CIR, 17.2 ASIR), Hail (12.5%; 6 CIR, 7.3 ASIR), Baha (11.6%; 5.9 CIR, 9.3 ASIR), and Najran (9%; 4.2 CIR, 5 ASIR). However, the CIR and ASIR for these regions, with the exception of Jouf, are still lower than the annual predicted values based on the equations for the linear regression: $4.28 + (0.76 \times 8 \text{ years} = 10.4)$ per 100,000 women for the CIR and $8.8 + (0.9 \times 8 \text{ years} = 16)$ per 100,000 women for the ASIR. The smallest changes in the CIR and ASIR were detected in the regions of Qassim (−10.7%; −1.5 CIR, 1.4 ASIR), Jazan (−1.7%; 1.1 CIR, 2.2 ASIR), and Tabuk (2%; 2.4 CIR, 4.8 ASIR). Therefore, these regions recorded down-trending rates with negative values from 2001 to 2008. The likely explanation

Table 4 Differences in the percentage, crude incidence rate, and age-standardized incidence rate of female breast cancer cases in the regions of Saudi Arabia between 2001 and 2008

Regions	Percentage			Crude incidence rate per 100,000			Age-standardized incidence rate per 100,000		
	2008	2001	Difference	2008	2001	Difference	2008	2001	Difference
Asir	15.5	11	4.5	6.4	2.8	3.6	9	4.8	4.2
Baha	19.1	7.5	11.6	7.2	1.3	5.9	10.8	1.5	9.3
Jazan	14.1	15.8	−1.7	3.8	2.7	1.1	6	4.2	2.2
Madinah	20.4	15.9	4.5	9.1	4.1	5	12.2	7.8	4.4
Hail	24.4	11.9	12.5	8.9	2.9	6	11.9	4.6	7.3
Qassim	21.7	32.4	−10.7	7.8	9.3	−1.5	13.3	11.9	1.4
Riyadh	23.9	18.6	5.3	15	9.5	5.5	24.2	17.5	6.7
Makkah	27.4	23	4.4	15.4	7.4	8	21.6	13	8.6
Najran	20.9	11.4	9.5	7.2	3	4.2	10.8	5.8	5
Jouf	33.3	9.1	24.2	12.5	1.3	11.2	19.4	2.2	17.2
Tabuk	22	20	2	8.8	6.4	2.4	17.2	12.4	4.8
Eastern region	32.4	26	6.4	19.7	12	7.7	31.8	22	9.8
Northern region	13	4	9	5.4	4.2	1.2	10.5	8.3	2.2

Abbreviation: CI, confidence interval.

for the down-trending rates with negative values in certain regions include insufficient screening programs and that a smaller number of women are undergoing diagnostic tests for breast cancer.

Discussion

The descriptive epidemiology of breast cancer in Saudi Arabia provides an important explanation for the recent trend, confirming the significance of the disease among women. The results of our study are based on the data recorded in the SCR, showing that female breast cancer is one of the most significant causes of disease among women.[17,18] The findings of our study indicate that the eastern region, Makkah, and Riyadh have the highest overall CIRs and ASIRs for female breast cancer in Saudi Arabia, whereas the CIRs and ASIRs in these regions did not increase above the expected levels during 2001 to 2008. Alternatively, the regions of Jazan, Baha, and Najran had the lowest values in the average CIR and ASIR. The age group most affected by breast cancer in Saudi Arabia and in other developing countries is women younger than 50 years of age.[5–8] However, developed countries have higher breast cancer incidence rates among women aged 50 years and older.[19]

In this study, we have reported the changes in the percentage, CIR, and ASIR from 2001 to 2008. Jouf had the highest differences in rates, which were above the predicted values for the CIR and ASIR during 2001 to 2008. These differences suggest that the region of Jouf has been affected more by female breast cancer during an 8-year period (2001–2008). In addition, the rates of female breast cancer decreased in the regions of Qassim, Jazan, and Tabuk. These regions had the lowest changes, with down-trending in the CIR and ASIR of the disease from 2001 to 2008.

In our descriptive epidemiological study, we suggest conducting screening programs for the early detection and treatment of breast cancer in Saudi women. The target areas for breast cancer screening programs are the regions with highest CIRs and ASIRs. In addition, we try to explore the distribution of female breast cancer cases among Saudi women and provide very important information for health researchers. Therefore, further hypothesis tests may be generated to study the potential risk factors of breast cancer in different regions of Saudi Arabia. The most common types of analytical observational epidemiological studies are case–control and cohort studies. Both studies can be used to determine the association between the risk factors and breast cancer.[13] In addition, these epidemiological studies will assist in the prevention of breast cancer through identifying the major risk factors that attribute to the increase of the CIR and ASIR. In addition, the availability of cancer reports from SCR may encourage researchers to conduct more descriptive epidemiological studies for other types of cancer among the Saudi population.

Conclusion

It is clear from the epidemiological analysis of the reports registered by the SCR from 2001 to 2008 that the CIRs and ASIRs of female breast cancer are increasing annually. Jazan, Baha, and Najran had the lowest average CIRs and ASIRs of female breast cancer, whereas the linear trend upward is a concern in certain regions, such as the eastern region, Makkah, and Riyadh. As discussed earlier,

the region of Jouf recorded the greatest significant differences of the CIRs and ASIRs between 2001 and 2008, with Qassim, Jazan, and Tabuk having the lowest. The majority of women with breast cancer are in a younger age group. However, further analytical epidemiological research is needed to identify the potential risk factors that have contributed to the increase in the occurrence of breast cancer among Saudi women.

Disclosure

The authors report no conflicts of interest in this work.

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