

# Female breast cancer incidence and mortality in 2011, China

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**Background:** Breast cancer is the most common cancer diagnosis in women. During the past 30 years, mortality of breast cancer in Chinese women showing a gradual upward trend, it has become the crucial death reasons of female.

**Methods:** In 2014, there were 234 population-based cancer registries submitting their data of 2011 to the National Central Cancer Registry (NCCR) of China and 177 cancer registries' data were selected after quality evaluation. The selected cancer registries were classified as urban areas and rural areas, in each level. The crude incidence and mortality rates of female breast cancer were calculated by age-groups. Age-standardized rates were described by China and World standard population. And the national population data of China was used to combine with the cancer registries' data to estimate the female breast cancer burden in 2011 in China.

**Results:** The estimated number of female breast cancer cases was 248,620. The crude incidence rate, age-standardized rate by China and World population were 37.86 per 100,000, 28.51 per 100,000 and 26.65 per 100,000, respectively. The estimated number of female breast cancer death in 2011 of China was about 60,473. The crude, age-standardized mortalities by China population and World population were 9.21 per 100,000, 6.57 per 100,000 and 6.38 per 100,000, respectively. The incidence and mortality rates were both higher in urban areas than rural areas. Trend of age-specific incidence rates in urban and rural was similar, reaching peak at 55-59 years old. The trend of age-specific mortality rates was very similar before 60 between urban and rural areas, but after that, the urban areas curve was rapidly mounting as the age growing and much higher than rural.

**Conclusions:** Breast cancer is still a major health burden for Chinese women especially in urban areas. Prevention strategies such as weight control, high-quality screening, diagnosis and treatment may help control the disease.

**Keywords:** Breast cancer; cancer registry; incidence; mortality; China

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## Introduction

Breast cancer is the most common cancer diagnosis in women. It was estimated there were 1.7 million new cases and 0.5 million cancer deaths in 2012 of the world (1). Family history, overweight, high breast density, environmental factors such as X- and  $\gamma$ -radiation, breast-feeding, hormones etc. are attributed to breast cancer (2). With the development of industry and society of China, these risk factors are more frequently exposed to. During the past 30 years, mortality of female breast cancer in Chinese women showing a gradual

upward trend, it has become the crucial death reasons of female (3).

The National Central Cancer Registry (NCCR) of China has been collecting data on patient demographics, primary tumor site and tumor morphology since established 2002, playing an important role in cancer surveillance. This paper estimated the status of female breast cancer and described the characteristics of incidence and mortality by different areas and age groups in China in 2011, based on existing population-based cancer registries' data. The updated results not only provide an overview of national

**Table 1** The quality control index of female breast cancer in 2011 of China

Areas	M/I	MV %	DCO %	UB %
All	0.25	89.74	0.60	0.26
Urban areas	0.23	90.58	0.55	0.30
Rural areas	0.29	87.95	0.70	0.19

M/I, mortality to incidence rate ratio; MV %, percent of proportion of morphological verification; DCO %, percent of proportion of death certification only; UB %, percent of proportion of unclear diagnosis.

wide but also supply important clues to prevention and control strategies for female breast cancer.

## Materials and methods

### *Incidence and mortality data*

The NCCR of China is responsible for cancer data collection, evaluation and publication from population-based cancer registries. The cancer information was reported to the cancer registries from local hospitals, community health centers, including the Basic Medical Insurances for Urban Residents and the New-Rural Cooperative Medical System. The Vital Statistical Database was linked with the cancer incidence database for identifying cases with death certificate only (DCO) and follow-up. By 1 June 2014, there were 234 cancer registries (98 cities and 136 counties) from 31 provinces submitted data of 2011 to NCCR, covered about 221,390,275 population, accounting for 16.43% of the national population. All cancer cases were classified according to the International Classification of Diseases for Oncology, 3<sup>rd</sup> edition (ICD-O-3) and the International Statistical Classification of Diseases and Related Health Problems 10<sup>th</sup> Revision (ICD-10). Invasive cases of breast cancer (ICD10: C50) were extracted and analyzed from the overall cancer database. After data quality evaluation (4,5), a total of 177 population-based cancer registries distributed in 28 provinces (77 in urban and 100 in rural) were selected for this study, covered a total of 175,310,169 population, covered about 13.01% of the national population, including 88,655,668 males and 86,654,501 females (48,954,104 in urban areas, 37,700,397 in rural areas).

### *Population data*

The population was estimated based on the 5<sup>th</sup> and 6<sup>th</sup>

National Population Census data provided by the National Statistics Bureau of China, taking into account of the changes of age composition, gender ratio and the proportion of urban and rural transformation released by the website of National Bureau of Statistics (<http://data.stats.gov.cn/>). The national population in 2011 were stratified by area (urban/rural), gender (male/female) and 19 age groups (0-, 1-4, 5-84 by 5 years, 85+ years). The changes of age specific death probability were also adjusted when calculating population. Linear changes were assumed in each age group between the fifth and sixth Population Census.

### *Statistical analysis*

Incidence and mortality rates were calculated by area and age groups. The number of new cases and deaths were estimated using the 5-year age-specific cancer incidence/mortality rates and the corresponding populations. All incidence and mortality rates were age standardized to the World standard population (Segi's population, ASR<sub>wld</sub>) and Chinese population in 2000 (ASR<sub>cn</sub>), and expressed per 100,000 person-years. Cancer incidence is defined as the number of new cancer cases occurring in a defined population within a specified period of time. The cumulative risk of developing or dying from cancer before 75 years of age (in the absence of competing causes of death) was calculated and presented as a percentage. Software including MS-Excel, IARCcrgTools2.05 issued by IARC and IACR were used for data checking and evaluation. SAS software was used to calculate the incidence and mortality rates.

## Results

A total of 177 population-based cancer registries with qualified cancer statistics were selected in this study after quality evaluation. As shown in *Table 1*, the percent of proportion of morphological verification (MV %), percent of proportion of DCO (DCO %), and mortality to incidence rate (M/I) ratio for the national pooled data were 89.74%, 0.60% and 0.25 respectively. In urban areas, the MV %, DCO %, and M/I ratio were 90.58%, 0.55% and 0.23 respectively. In rural areas, they were 87.95%, 0.70% and 0.29.

### *Incidence*

Breast cancer was the first leading cancer incidence in female, and was estimated about 248,620 new cases be

**Table 2** Female breast cancer incidence in 2011 of China

Areas	No. cases	Crude rate (1/10 <sup>5</sup> )	Ratio (%)	ASRcn (1/10 <sup>5</sup> )	ASRwld (1/10 <sup>5</sup> )	Cumulative rate 0-74%	TASR 35-64 (1/10 <sup>5</sup> )	Rank
All	248,620	37.86	17.10	28.51	26.65	2.87	67.91	1
Urban areas	158,087	46.74	19.47	33.66	31.63	3.45	78.80	1
Rural areas	90,533	28.43	14.11	22.59	20.96	2.21	55.19	2

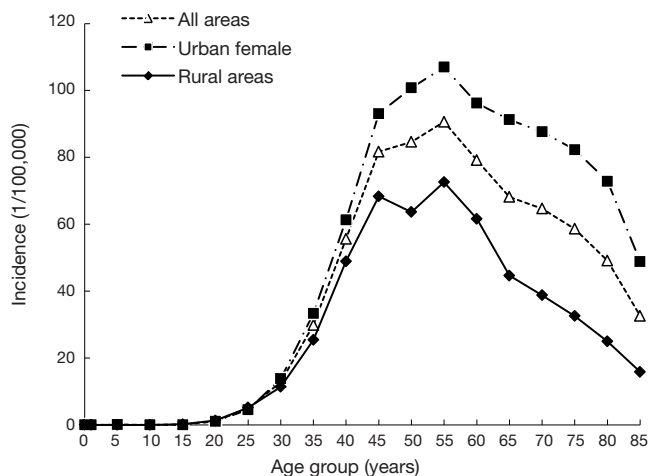
ASRcn, age-standardized rate (using China standard population, 2000); ASRwld, age-standardized rate (using World standard population); TASR, truncated age-standardized rate (using World standard population).

**Table 3** Age-specific incidence rates of female breast cancer in 2011, China (1/100,000)

Age group (years)	All areas	Urban areas	Rural areas
All	37.86	46.74	28.43
0-	0.00	0.00	0.00
1-	0.00	0.00	0.00
5-	0.02	0.05	0.00
10-	0.00	0.00	0.00
15-	0.09	0.00	0.16
20-	1.17	1.04	1.27
25-	4.83	4.54	5.16
30-	12.82	13.81	11.37
35-	29.86	33.28	25.39
40-	55.60	61.29	48.90
45-	81.71	93.09	68.33
50-	84.60	100.80	63.64
55-	90.64	106.99	72.58
60-	79.17	96.21	61.63
65-	68.16	91.27	44.65
70-	64.67	87.65	38.76
75-	58.63	82.30	32.56
80-	49.10	72.84	24.96
85+	32.58	48.85	15.81

diagnosed in China in 2011 (158,087 in urban and 90,533 in rural areas), accounting for 17.10% of all new cancer cases in women. The overall crude incidence rate was 37.86 per 100,000 (28.51/100,000 of the ASRcn and 26.65/100,000 of ASRwld).

In urban areas, the crude incidence was 46.74 per 100,000, with 19.47% ratio, ranking first among all female cancer. After age standardization by China and world population, the standardized incidence rates were 33.66/1,000,000 and 31.63/100,000 respectively. In rural areas, the crude incidence

**Figure 1** Age-specific incidence rates of female breast cancer in 2011, China.

rate was 28.43 per 100,000 (22.59 per 100,000 of ASRcn and 20.96 per 100,000 of ASRwld), accounting for 14.11%, lower than urban areas, ranking second (Table 2).

Age-specific incidence rates by age groups and areas were shown in Table 3 and Figure 1. The overall age-specific incidence rates were low before 25-29, but dramatically increased after that until 55-59 years, then gradually decreased. The age-specific incidence rates were similar before 35-39 between urban and rural areas. Although the peak was at 55-59 age group both in urban and rural areas, the declining trend of urban areas was slower than in rural areas after that.

### Mortality

According to our estimation, there were 60,473 cases died of female breast cancer in 2011, China (34,292 in urban areas and 26,181 in rural areas), accounting for 7.88% of all

**Table 4** Female breast cancer mortality in 2011, China

Areas	No. cases	Crude rate (1/10 <sup>5</sup> )	Ratio (%)	ASRcn (1/10 <sup>5</sup> )	ASRwld (1/10 <sup>5</sup> )	Cumulative rate 0-74%	TASR 35-64 (1/10 <sup>5</sup> )	Rank
All	60,473	9.21	7.88	6.57	6.38	0.70	14.18	6
Urban areas	34,292	10.14	8.67	6.95	6.77	0.73	14.10	5
Rural areas	26,181	8.22	7.04	6.17	5.96	0.67	14.25	5

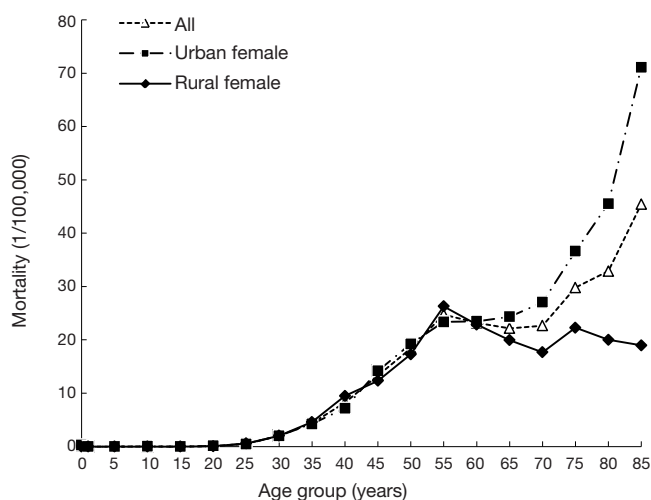
ASRcn, age-standardized rate (using China standard population, 2000); ASRwld, age-standardized rate (using World standard population); TASR, truncated age-standardized rate (using World standard population).

**Table 5** Age-specific mortality of female breast cancer in 2011, China (1/100,000)

Age group (years)	All areas	Urban areas	Rural areas
All	9.21	10.14	8.22
0-	0.12	0.27	0.00
1-	0.00	0.00	0.00
5-	0.00	0.00	0.00
10	0.02	0.05	0.00
15-	0.00	0.00	0.00
20-	0.09	0.13	0.06
25-	0.52	0.46	0.59
30-	2.03	2.01	2.04
35-	4.39	4.24	4.59
40-	8.25	7.19	9.50
45-	13.33	14.18	12.33
50-	18.39	19.24	17.29
55-	24.76	23.36	26.29
60-	23.18	23.49	22.87
65-	22.16	24.33	19.94
70-	22.66	27.07	17.68
75-	29.80	36.64	22.27
80-	32.87	45.52	20.01
85+	45.44	71.11	18.98

cancer deaths in women, ranking sixth. The crude incidence rate was 9.21 per 100,000, after age standardization by China and World population, the standardized rates were 6.57/100,000 and 6.38/100,000 respectively.

Stratified by area, the mortality in urban areas was higher than rural areas, both for crude and age-standardized, but the ratios were both ranked fifth among all female cancer deaths. The crude mortality in urban areas was 10.14 per

**Figure 2** Age-specific mortality rates of female breast cancer in 2011, China.

100,000 (6.95 per 100,000 of ASRcn and 6.77 per 100,000 of ASRwld), with 8.67% ratio. In rural areas, the crude mortality was 8.22 per 100,000 (6.17 per 100,000 of ASRcn and 5.96 per 100,000 of ASRwld), accounting for 7.04% (Table 4).

Age-specific mortality rates were shown in Table 5 and Figure 2. The age-specific mortality rates were very similar before 60 between urban areas and rural areas, where after 30-35 years old it dramatically increased. After 60-65 years old, the urban areas curve was rapidly mounting as the age growing and much higher than rural.

## Discussion

In this study, we described the epidemiology of female breast cancer of China in 2011 based on data from 177 population-based cancer registries. It was estimated 248,620 new cases were diagnosed in China in 2011 and 60,473 died of female

breast cancer. The age-standardized incidence and mortality rates by using World standard population (Segi's population) were 26.65 per 100,000 and 6.38 per 100,000 respectively. The incidence and mortality in urban areas were both higher than rural areas. The trend of age-specific incidence rates in urban and rural was similar, reaching peak at 55-59 years old. The mortality rates increased with age, and after 60-65 years old mortality in urban was higher than rural.

Both the crude and age-standardized incidence in urban were much higher than rural areas which probable were the consequence of more frequently exposed to risk factors than rural women, such as larger proportions of nulliparous and not breastfed women (6), drinking which related to the high income (7,8) and overweight (9,10). The breast cancer mortality rate was 9.21 per 100,000 in 2011, lower than the world average (12.9/100,000) (1,11), however, it still was a major reason cause of female deaths for Chinese women. This was likely because the low survival rate and late diagnosed stage. It was estimated that five-years overall survival rate of China (76.5%) is lower than western countries such as USA (88% for all stage and races) (12), and patients diagnosed mostly at stage I & II (13), compared to urban areas, women in rural areas are more likely to be diagnosed at later breast cancer stages (14). These warn that we still need to robust the measures of breast screening and treatment, especially in rural areas.

At the periods before menopause and after that, the age-specific incidence curve of rural areas had double peak, different with the gradually rising urban curve which was similarly to the single peak trend as shown by the 1973-2007 age-specific incidence curves in Shanghai (15), probably due to the diminishing levels of circulating estrogens, the major reason for rural areas, and more common risk factors. The urban age-specific mortality curve and M/I were higher than rural areas, suggested that the treatment levels in rural areas is lower than urban areas.

The data about female breast cancer provided in this study are the most up-to-date data, reflecting the only available population-based information on female breast cancer of China. We estimated the overall breast cancer incidence and mortality of China and by area with techniques, so the projected numbers of new cancer cases and deaths should be interpreted with caution because these estimates are model based. Population-based cancer registries in China have provided with cancer incidence and mortality data for many years, yet there are still many regions with low or no accurate registry data. NCCR has been making great efforts to improve the data

quality, and more and more data from cancer registries would be used and the accuracy and representative would be better in the future.

In conclusion, female breast cancer is still a major health burden for Chinese women, especially in urban areas. Primary prevention strategies such as weight control, breastfeeding promotion, non-smoking and quit drinking should be improved, particularly in urban where more common. For menopausal women, circulating estrogens levels diminishing, highest incidence of breast cancer period, it should be given more patient, drug therapy is in need if necessary. And increased efforts to provide high-quality screening, diagnosis and treatment may also reduce the breast cancer mortality.

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### Footnote

*Conflicts of Interest:* The authors have no conflicts of interest to declare.

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