Vital Surveillances

Trends in the Incidence, Mortality and Lifetime Risks of Female Breast and Cervical Cancer — Guangdong Province, China, 2023

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ABSTRACT

Introduction: This study aims to report the epidemiological trends and provide updated estimates and lifetime risks for breast and cervical cancers among women in Guangdong province.

Methods: A Bayesian age-period-cohort model was applied to project incidence and mortality rates for 2023. The adjusted for multiple primaries (AMP) method was used to calculate the lifetime risks of developing and dying from breast and cervical cancer. Joinpoint analysis was employed to describe the temporal trends.

Results: The age-standardized incidence rate (ASIR) of female breast cancer increased from 2012 to 2019 in Guangdong province, with a particularly pronounced increase noted in the rural areas. The ASIR for cervical cancer among women aged over 55 increased in both urban and rural areas, whereas a declining trend was observed among women under the age of 55. The age-standardized mortality rates (ASMRs) for both breast cancer and cervical cancer demonstrated upward trends among women aged over 55, while no significant trend in ASMR was found for women under 55 years. In 2023, the estimated incidence rates of breast cancer and cervical cancer would be $50.81/10^5$ (ASIR would be $35.57/10^5$) and $15.31/10^5$ (ASIR would be $10.41/10^5$) respectively, with corresponding mortality rates of $10.78/10^5$ (ASMR would be $7.15/10^5$) and $6.11/10^5$ (ASMR would be $3.93/10^5$) for these cancers.

Conclusions: Breast cancer continues to pose a significant threat to women's health in both rural and urban areas of Guangdong, whereas cancer prevention and control programs for cervical cancer have shown positive impacts among the younger population. Greater emphasis should be placed on women aged over 55 to halt the rising mortality rates of both cancers within this population.

Breast cancer is the leading cancer diagnosis and cause of death in women worldwide, and cervical cancer ranks among the top five most common cancers in women (*1*). In China, the incidence rates of both cancers are increasing, while mortality rates show varying trends across different age groups and regions (*2*–*3*).

China has devoted significant resources to cancer prevention efforts. In 2009, the country initiated a nationwide free screening program for breast and cervical cancers targeting rural women (*4*). The Healthy China Action Plan (2019–2030) further proposed measures, including improving screening coverage and promoting human papillomavirus (HPV) vaccination (*5*).

Regional epidemiological studies of these cancers are crucial for developing precise and effective local prevention and control strategies. The female population in Guangdong province represents 8.6% of China's total female population. Guangdong has a high fertility rate, high population density, and unbalanced regional development. The incidence and mortality rates of female breast cancer in Guangdong exceed the national average, while cervical cancer rates are slightly lower (*6*–*7*). Despite substantial investments in breast and cervical cancer prevention and control in Guangdong over recent decades, research on disease burden trends remains inadequate. Therefore, this study aims to elucidate the epidemiological trends and provide current estimates and lifetime risk assessments for breast and cervical cancers in Guangdong Province, China, which can inform targeted prevention and control policies and provide a reference for similar regions.

METHODS

Data Sources

In 2019, 40 population-based cancer registries in

Guangdong province provided high-quality cancer surveillance data, covering 38.08 million (38.37% of the total provincial population). Data quality control standards were based on the "Guideline for Chinese Cancer Registration" and the criteria of the International Agency for Research on Cancer/International Association of Cancer Registries (IARC/IACR). This analysis focused on female breast cancer (ICD10: C50) and cervical cancer (ICD10: C53). Temporal trends were analyzed using data from 7 registries with continuous, high-quality data available from 2012 to 2019, representing 14.29% of Guangdong's total population. Detailed information about the population-based cancer registration system in Guangdong province is available in previously published sources (*6*). Population and all-cause mortality data were obtained from the Guangdong Provincial Center for Disease Control and Prevention.

Statistical Analysis

A Bayesian age-period-cohort model was applied to project age-specific incidence and mortality rates for 2023, using aggregated female breast and cervical cancer data from 40 registries in 2019 and trends in age-specific rates from 7 registries between 2012 and 2019. Age-standardized incidence and mortality rates (ASIR/ASMR) were calculated based on Segi's world standard population. The lifetime risks of developing and dying from cancer were calculated using the "adjusted for multiple primaries (AMP)" method (*8*–*9*). Temporal trends were analyzed using Joinpoint software (version 4.9.1.0, Statistical Research and Applications Branch, National Cancer Institute, Bethesda, MD, USA), with results expressed as the average annual percentage change (AAPC). All findings were stratified by area (total, urban, and rural) and age group (all ages, <55 years, and ≥55 years). We used age 55 as the cutoff to distinguish between pre-menopausal and post-menopausal status to better understand disease burden and temporal trends in these different groups. Statistical analyses were performed using R software (version 4.2.2, R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Trends in ASIR from 2012 to 2019

The ASIR of female breast cancer in Guangdong province showed a significant upward trend from 2012 to 2019 (AAPC: 3.4%), with a more pronounced increase in rural areas compared to urban areas. ASIRs increased across all age groups, with women aged 55 and older experiencing greater increases than those under 55. For cervical cancer, while there was no statistically significant change in overall ASIR, a decline was observed among women under 55 years (AAPC: −2.3%), particularly in rural areas (AAPC: −3.2%). Conversely, the ASIR for cervical cancer among women aged 55 and older showed an increasing trend in both urban and rural areas (Figure 1, Supplementary Table S1, available at https://weekly.chinacdc.cn/).

Trends in ASMR from 2012 to 2019

No statistically significant change was observed in the age-standardized mortality rate (ASMR) of female breast cancer in Guangdong province from 2012 to 2019. However, the ASMR in women aged 55 and older showed an upward trend (AAPC: 3.6%), primarily due to increases among urban women in this age group. Similarly, while no statistically significant trend was found in the overall ASMR for cervical cancer, there were significant increases in both urban (AAPC: 9.3%) and rural areas (AAPC: 7.5%) for women aged 55 and older. No significant trends were observed for women under 55 for either cancer (Figure 2, Supplementary Table S1).

Estimated Incidence and Lifetime Risks in 2023

In 2023, an estimated 25,444 new cases of female breast cancer were projected to occur in Guangdong province, corresponding to a crude incidence rate of $50.81/10^5$ and an ASIR of $35.57/10^5$. The lifetime risk of developing breast cancer was calculated to be 4.24%. For cervical cancer, the estimated number of new cases was 7,666, with a crude incidence rate of $15.31/10^5$ and an ASIR of $10.41/10^5$ (Table 1). The lifetime risk of being diagnosed with cervical cancer was 1.44%.

Estimated Mortality and Lifetime Risks in 2023

In 2023, breast cancer was estimated to cause 5,399 deaths among women in Guangdong province, with a crude mortality rate of $10.78/10^5$ and an ASMR of $7.15/10^5$. The lifetime risk of dying from breast cancer was 1.11%. For cervical cancer, an estimated 3,060 deaths were projected to occur, with a crude mortality rate of $6.11/10^5$ and an ASMR of $3.93/10^5$. The

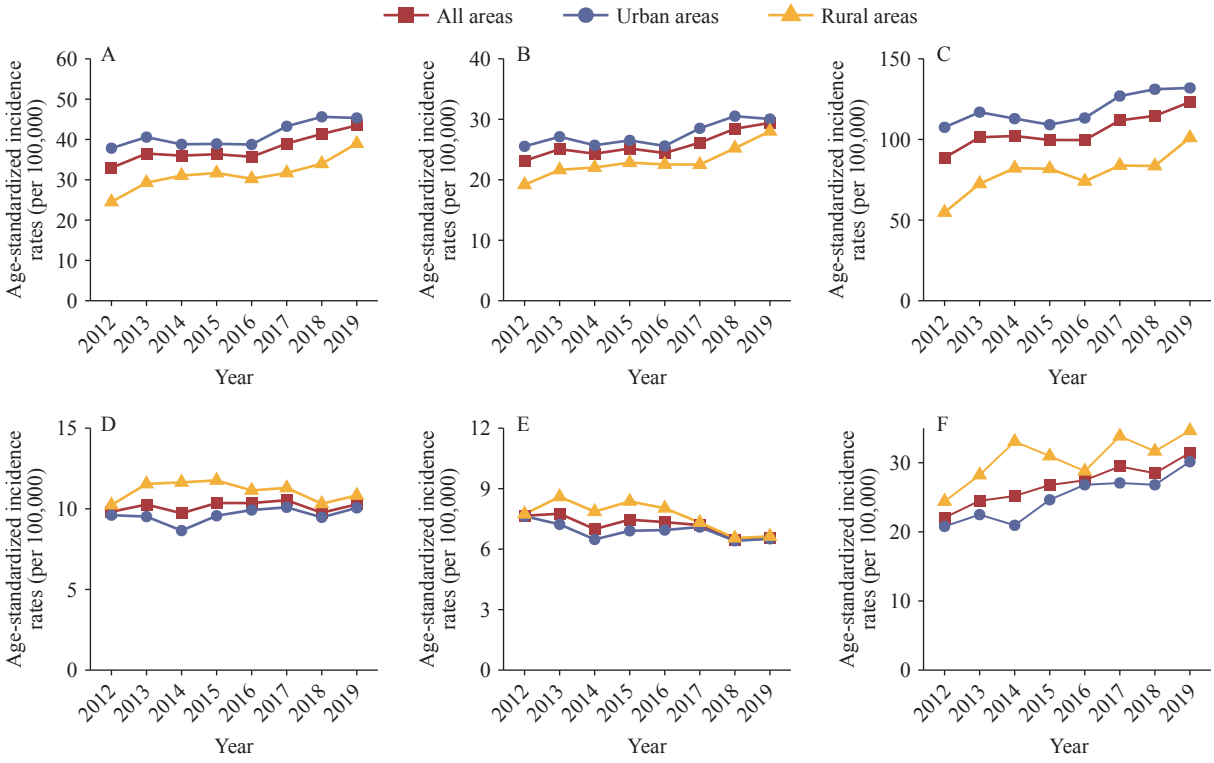

FIGURE 1. Trends in the incidence rates of breast and cervical cancers in Guangdong Province by area and age group, 2012–2019. (A) All ages for breast cancer; (B) <55 years for breast cancer; (C) ≥55 years for breast cancer; (D) All ages for cervical cancer; (E) <55 years for cervical cancer; (F) ≥55 years for cervical cancer.

lifetime risk of dying from cervical cancer was 0.67%. In contrast to incidence patterns, both the ASMR and lifetime mortality risk for cervical cancer were higher in rural areas than in urban areas (Table 1). The age-specific incidence and mortality rates and lifetime risks are illustrated in Figure 3 and Supplementary Figure S1 (available at https://weekly.chinacdc.cn/), respectively.

DISCUSSION

We estimated that the incidence rates of breast cancer and cervical cancer in Guangdong would be $50.81/10^5$ (ASIR would be $35.57/10^5$) and $15.31/10^5$ (ASIR would be $10.41/10^5$) respectively, with corresponding mortality rates of $10.78/10^5$ (ASMR would be $7.15/10^5$) and $6.11/10^5$ (ASMR would be $3.93/10^5$) for these cancers in 2023. Compared to the national estimates for 2022 in China (*10*), the ASIR and ASMR of breast cancer in Guangdong province remain higher than the national level, while the ASIR and ASMR of cervical cancer are lower than the national level. The lifetime risk of dying from cervical cancer among rural women was higher than that among urban women, while urban women faced higher lifetime risks of both developing and dying from breast cancer than rural women. The lifetime risks of developing and dying from breast cancer in Guangdong province are slightly higher than the national average in China, but both are lower than those in Japan and the United States (*11*). Conversely, the lifetime risks of developing and dying from cervical cancer in Guangdong province are slightly lower than the national average in China, but both are higher than those in Japan and the United States (*11*). The burden of breast cancer and cervical cancer in Guangdong accounts for a substantial proportion of the national burden, and breast cancer will remain the primary threat to women's health in Guangdong in both rural and urban areas for decades. Additionally, greater attention should be directed toward early detection and treatment of breast and cervical cancers for women over 55 years to halt the upward trends in mortality rates among this population.

The ASIR of breast cancer increased more rapidly in rural areas compared to urban areas across all age subgroups, though the overall disease burden remained higher in urban areas. Several factors may contribute to the rising ASIR trend, including the implementation of

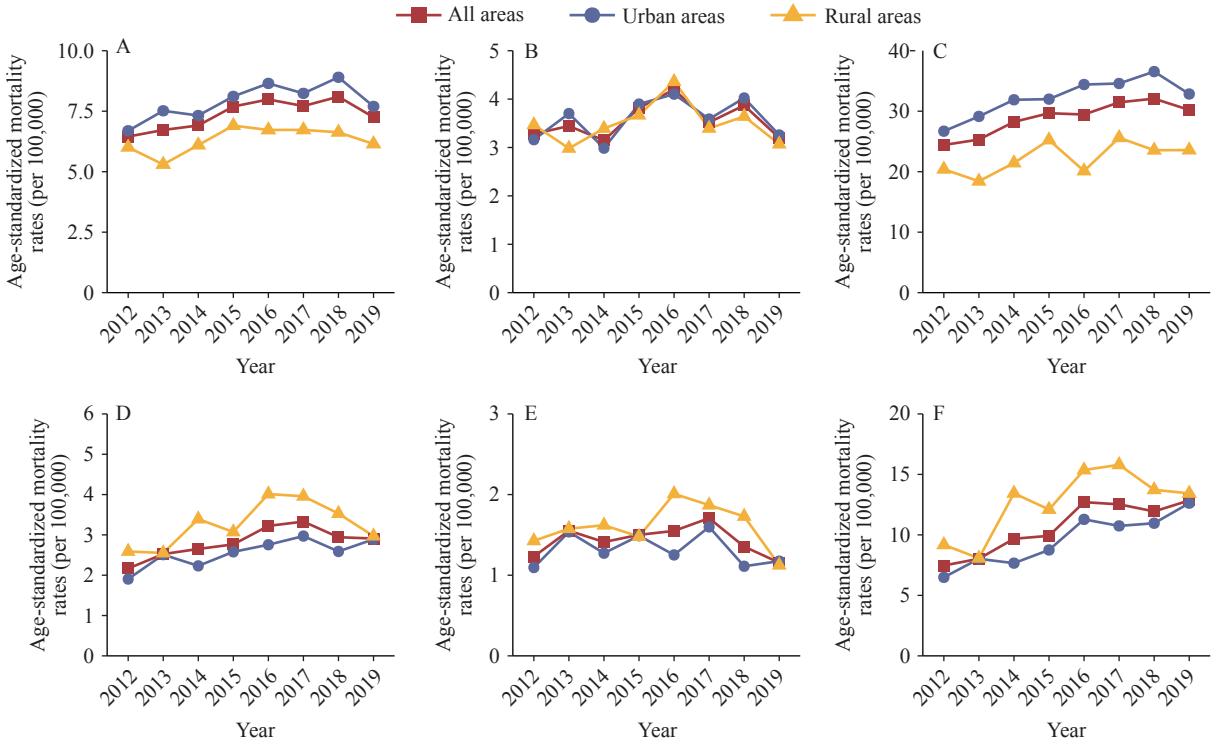

FIGURE 2. Trends in the mortality rates of breast and cervical cancers in Guangdong Province by area and age group, 2012-2019. (A) All ages for breast cancer; (B) <55 years for breast cancer; (C) ≥55 years for breast cancer; (D) All ages for cervical cancer; (E) <55 years for cervical cancer; (F) ≥55 years for cervical cancer.

free breast and cervical cancer screening programs in rural areas since 2009, which has increased detection rates while potentially decreasing mortality through early detection. The heavier disease burden in urban areas likely stems from greater exposure to risk factors such as work stress, obesity, physical inactivity, delayed childbearing, nulliparity, and reduced breastfeeding duration (*12*–*13*). For instance, women who did not breastfeed after childbirth had a 3.26-fold increased risk of breast cancer compared to those with a history of breastfeeding. Additionally, women with at least one live birth showed a significantly decreased risk compared to nulliparous women [odds ratio (*OR*)=0.09] (*12*). These findings underscore the importance of identifying key risk factors for implementing targeted interventions and screening measures in both rural and urban areas, for both younger and older women. The statistically significant rise in ASMR of breast cancer was observed only in women over 55 years, while no declining trend was evident in women under 55. These patterns suggest that screening benefits have yet to be fully realized in either region, and women over 55 in both rural and urban areas should remain a primary focus for breast cancer prevention and control efforts. Furthermore, considering the increasing ASIR and ASMR among older women, coupled with rising life expectancy and demographic shifts toward an aging population, reconsideration of screening guidelines may be warranted, particularly raising the upper age limit to better protect older women with elevated risk.

The incidence and mortality rates of cervical cancer for women under 55 in both urban and rural areas showed decreasing trends, indicating that cancer prevention and control measures for cervical cancer are beginning to show positive effects in younger age groups. HPV vaccination represents a key primary prevention measure, especially for young women. Research has shown that HPV-16/18 prevalence gradually increased among women aged 35-50 in Guangdong, with two infection peaks observed in women over 50 years (9.6%) and under 25 (8.2%) (*14*). In November 2021, Guangdong Province issued the Work Plan for Free HPV Vaccination of School-Age Girls (2022–2024), aiming to fully immunize 90% of girls under 15 against HPV by 2030. This initiative is estimated to benefit more than 750,000 individuals annually. The policy has not only increased HPV vaccine accessibility and vaccination rates but also raised public awareness of cervical cancer

TABLE 1. The estimated incidence, mortality, and lifetime risks of breast and cervical cancers in Guangdong province by area and age group, 2023.

Site	Area	Age group (years)	Incidence				Mortality			
			Cases	Crude rates ($1/10^5$)	ASIR ($1/10^5$)	Lifetime risks (%)	Deaths	Crude rates ($1/10^5$)	ASMR ($1/10^5$)	Lifetime risks (%)
Breast	Total	All ages	25,444	50.81	35.57	4.24	5,399	10.78	7.15	1.11
		<55	14,145	37.23	24.83	1.79	2,071	5.45	3.57	0.27
		≥55	11,299	93.52	96.42	2.45	3,328	27.55	27.42	0.84
	Urban areas	All ages	13,798	55.80	38.89	4.68	2,958	11.96	7.91	1.31
		<55	7,735	40.98	26.86	1.95	1,089	5.77	3.76	0.28
		≥55	6,063	103.63	107.10	2.73	1,869	31.94	31.44	1.03
	Rural areas	All ages	11,646	45.94	32.29	3.81	2,441	9.63	6.42	0.93
		<55	6,410	33.53	22.78	1.64	982	5.14	3.38	0.25
		≥55	5,236	84.03	86.14	2.17	1,459	23.42	23.61	0.68
Cervix	Total	All ages	7,666	15.31	10.41	1.44	3,060	6.11	3.93	0.67
		<55	3,276	8.62	5.69	0.42	729	1.92	1.23	0.09
		≥55	4,391	36.34	37.15	1.02	2,331	19.29	19.19	0.58
	Urban areas	All ages	3,924	15.87	10.88	1.45	1,313	5.31	3.51	0.57
		<55	1,748	9.26	6.03	0.44	359	1.90	1.21	0.09
		≥55	2,177	37.21	38.39	1.01	955	16.32	16.58	0.48
	Rural areas	All ages	3,742	14.76	9.96	1.42	1,747	6.89	4.32	0.77
		<55	1,528	7.99	5.36	0.39	370	1.94	1.26	0.10
		≥55	2,214	35.53	36.07	1.03	1,377	22.09	21.66	0.68

Abbreviation: ASIR=age-standardized incidence rate; ASMR=age-standardized mortality rate.

prevention, establishing a solid foundation for achieving the goal of cervical cancer elimination.

Although screening rates for both breast and cervical cancer in China have increased over time, they remain suboptimal (*15*–*16*). Guangdong province initiated a free breast and cervical cancer screening program for rural women in 2009 and expanded it to urban areas in 2020. According to China Chronic Disease and Risk Factor Surveillance (CCDRFS) data from Guangdong, screening coverage has improved substantially. Among women aged 35 years and older, cervical cancer screening rates increased from 19.4% in 2013 to 47.1% in recent years, while breast cancer screening rates rose from 18.6% to 45.0%. However, significant urban-rural disparities persist. Cervical cancer screening rates in urban areas increased from 23.2% to 50.2%, compared to 13.3% to 38.7% in rural areas. Similarly, breast cancer screening rates in urban areas rose from 24.1% to 48.8%, versus 9.7% to 34.5% in rural areas. Despite these improvements, both the ASIR and ASMR for cervical cancer continue to rise among women over 55 years of age in both urban and rural areas, with faster increases observed in the urban populations. These findings suggest that screening and tertiary prevention efforts for cervical cancer must be strengthened for women above 55 years in all regions. Furthermore, as the population ages, the recommended screening age range for cervical cancer should be extended to include older women, given the increasing incidence and mortality rates amongst this group.

This study has several strengths. Firstly, we conducted age and region subgroup analyses to identify high-risk populations. Secondly, the population-based surveillance data used are representative of the province. However, there are also limitations. Firstly, surveillance sites in rural areas were fewer than in urban areas, potentially contributing to fluctuations in trend analysis. Secondly, large cities in Guangdong have significant migrant populations, which may affect the precision of the cancer registry and vital surveillance data. Consequently, mortality figures may be slightly underestimated, necessitating careful interpretation of the data.

Conflicts of interest: No conflicts of interest.

Acknowledgements: The Health Commission of Guangdong Province, Guangdong Provincial Bureau of Disease Control and Prevention, and Government

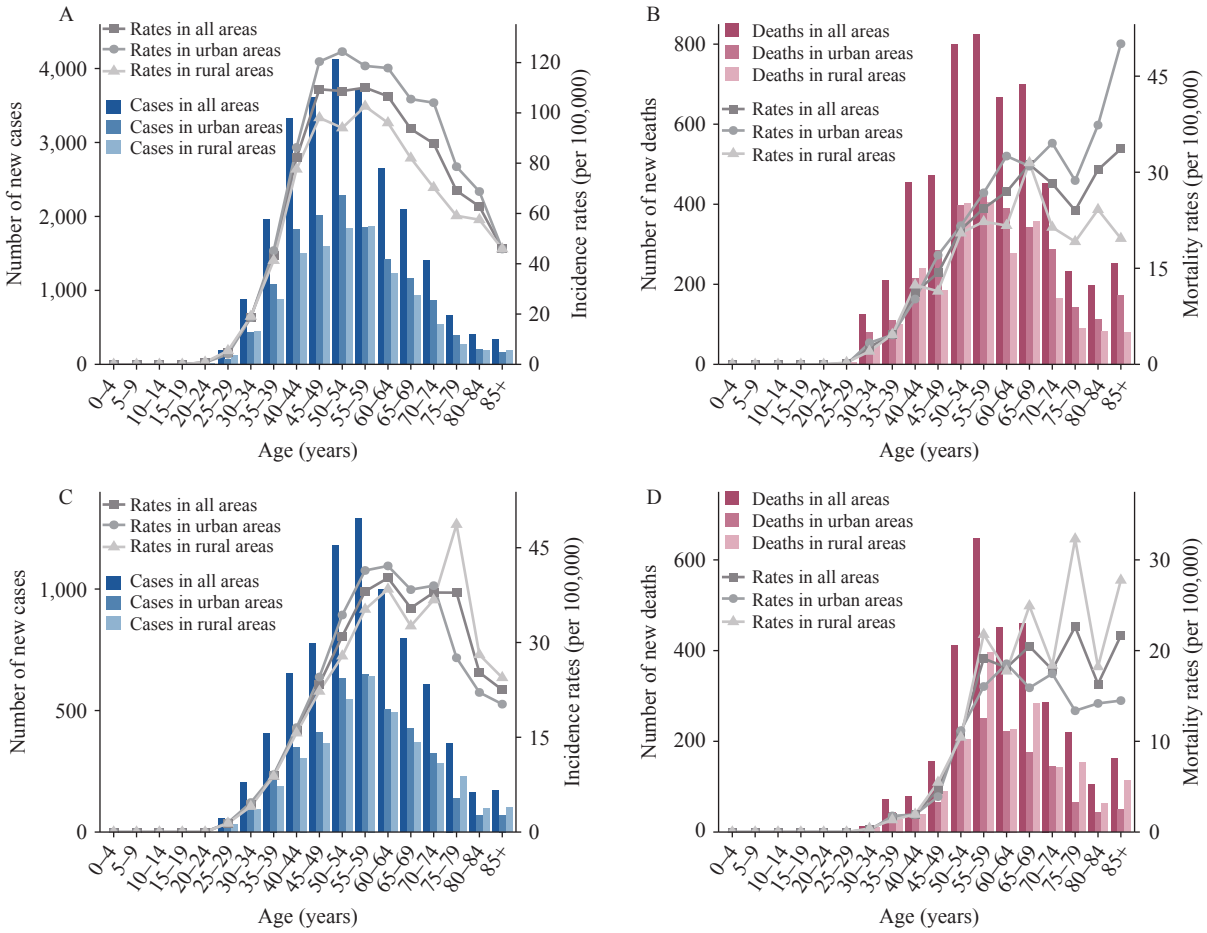

FIGURE 3. The cases/deaths and incidence/mortality rates of breast and cervical cancers in Guangdong Province by area and age group, 2023. (A) Cases and incidence rates for breast cancer; (B) Deaths and mortality rates for breast cancer; (C) Cases and incidence rates for cervical cancer; (D) Deaths and mortality rates for cervical cancer.

Affairs Service Center of Health Commission of Guangdong Province for their support of this study; The staff of population-based cancer registries in Guangdong Province for their efforts in data collection and quality control.

Funding: Supported by the talent support project established by Guangdong Provincial Center for Disease Control and Prevention [2023D010].

doi: 10.46234/ccdcw2025.157

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Submitted: March 17, 2025
Accepted: June 18, 2025
Issued: July 11, 2025

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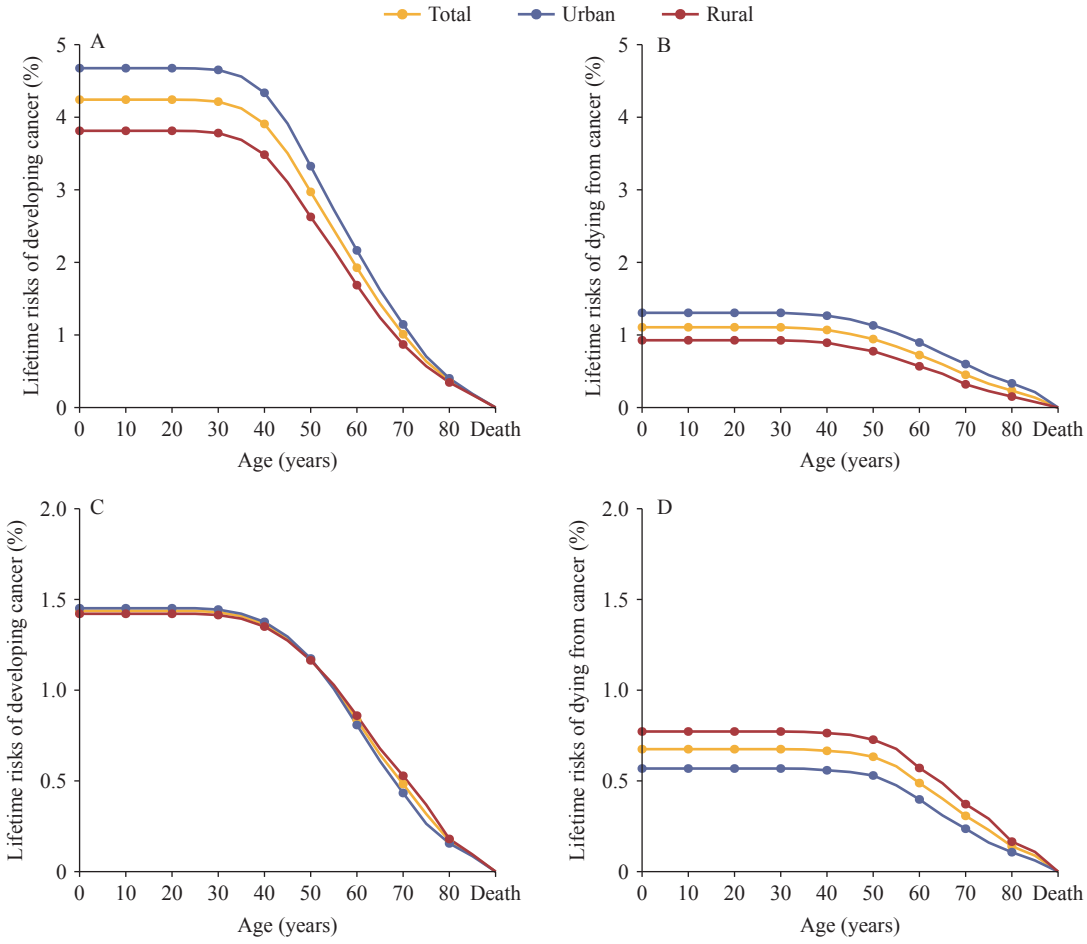
SUPPLEMENTARY MATERIAL

SUPPLEMENTARY TABLE S1. Trends for age-standardized incidence and mortality rates of breast and cervical cancers in Joinpoint analysis in Guangdong Province by area and age group, 2012–2019.

Site	Area	Age group (years)	Incidence		Mortality	
			AAPC (95% *CI*)	*P*	AAPC (95% *CI*)	*P*
Breast	Total	All	3.4 (1.8, 4.9)	0.002*	2.4 (−1.1, 5.9)	0.182
		<55	3.0 (1.5, 4.6)	0.003*	1.0 (−3.0, 5.2)	0.568
		≥55	3.9 (2.1, 5.7)	0.002*	3.6 (1.7, 5.5)	0.003*
	Urban areas	All	2.6 (0.9, 4.4)	0.009*	2.7 (−0.1, 5.5)	0.053
		<55	2.4 (0.7, 4.2)	0.015*	1.5 (−3.1, 6.2)	0.464
		≥55	2.9 (1.1, 4.7)	0.007*	3.5 (1.2, 5.9)	0.009*
	Rural areas	All	4.9 (2.4, 7.5)	0.003*	1.9 (−1.2, 5.0)	0.191
		<55	4.2 (2.3, 6.2)	0.002*	0.4 (−4.3, 5.3)	0.852
		≥55	6.1 (1.9, 10.5)	0.012*	3.1 (−0.7, 7.0)	0.093
Cervix	Total	All	0.4 (−0.9, 1.6)	0.496	3.5 (−0.2, 7.2)	0.061
		<55	−2.3 (−3.8, −0.8)	0.010*	−2.0 (−8.9, 5.4)	0.588
		≥55	4.5 (3.3, 5.8)	<0.001*	8.1 (4.2, 12.2)	<0.001*
	Urban areas	All	1.0 (−0.8, 2.8)	0.237	4.9 (1.2, 8.7)	0.017*
		<55	−1.7 (−3.4, 0.1)	0.060	−0.7 (−6.6, 5.4)	0.772
		≥55	5.3 (3.3, 7.3)	0.001*	9.3 (6.1, 12.6)	<0.001*
	Rural areas	All	−0.4 (−2.5, 1.8)	0.690	2.5 (−6.7, 12.5)	0.613
		<55	−3.2 (−5.6, −0.6)	0.023*	−2.4 (−11.2, 7.3)	0.615
		≥55	3.7 (0.5, 6.9)	0.029*	7.5 (0.6, 14.8)	0.038*

Abbreviation: AAPC=average annual percent change; *CI*=confidence interval.
* *P*<0.05.



SUPPLEMENTARY FIGURE S1. Lifetime risks of developing and dying from breast and cervical cancers within selected age intervals in Guangdong Province by area, 2023. (A) Risks of developing breast cancer; (B) Risks of dying from breast cancer; (C) Risks of developing cervical cancer; (D) Risks of dying from cervical cancer.