RESEARCH ARTICLE

Time Trends of Ovarian Cancer Incidence in China

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Abstract

The aim of this study was to examine the trend of ovary cancer incidence from 1999 to 2010 in China and predict the burden up to 2020. Crude incidence, age specific incidence and age-adjusted incidence rates were calculated. Joinpoint regression was performed to obtain estimated annual percentages and Bayesian age-period-cohort modeling was used to predict the incidence rate until the year 2020. In China, the crude rate of ovary cancer was 7.91/100,000 and the age-adjusted rate was 5.35/100,000 overall during period 1999-2010. The rates in urban regions were higher than in rural regions. A significant rising trend during 1999-2006 was followed by a drop during 2006-2010 in age-adjusted rates for urban females. In contrast, constant rise was observed in rural women. The decrease in ovary cancer of urban areas tended to be restricted to women aged 50 years and younger. In contrast, increases of ovary cancer in rural areas appeared in virtually all age groups. Although the age-adjusted incidence rate for ovary cancer was predicted to be reduced after year 2011, the crude rate was likely to be relative stable up to 2020. The burden of ovary cancer in China will continue to be relative stable due to the aging population.

Keywords: Ovarian cancer - incidence - trends - age-dependence - rural - urban - China

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Introduction

In 2008, it was estimated that 225,500 women were diagnosed with ovarian cancer and 140,200 women died from this disease worldwide. These values make ovarian cancer the eighth most common type of cancer and the seventh most common cause of cancer-related death among women (Jemal et al., 2011). There is wide geographical variation in the incidence of ovarian cancer.

Generally, the highest incidence rates were largely confined to developed countries, such as Northern Europe (13.3 per 100,000 person-years), the Western Europe (11.3 per 100,000 person-years) and Northern America (10.7 per 100,000 person-years). China (3.2 per 100,000 person-years) and Northern Africa (2.6 per 100,000 person-years) have the lowest reported incidence rates in 2002 (Parkin, Bray et al. 2005). However, ovary cancer incidence in China showed an upward trend in recent years (Jin et al., 1993; Marugame and Hirabayashi, 2007; Wong et al., 2012). Analysis of secular trends in cancer epidemiology is important to the understanding of disease etiology and for the assessment of public health control policy.

The purpose of this study was to investigate time trends of incidence rate of ovarian cancer in women diagnosed in China in the period 1999-2010. The results may be further understanding of the trends of ovary cancer incidence and provide scientific clues for strategy-making for ovary cancer prevention and control.

Materials and Methods

The incidence data of ovary cancer during the period 1999-2010 was provided by The National Cancer Registration. Disease for Oncology, version 10 (ICD10) was used to classify the cancer cases. In this study, the code for ovary cancer is C56. The detailed variables of each case including year and patient age at diagnosis and region (rural or urban area) were collected. Annual population estimates were obtained from the National Statistics Bureau for the same period.

In this study, we calculated the crude incidence rate, age specific incidence rate (from 25 to 85+, within 5-year groups), and the age-adjusted incidence rate. World Segi's population structure was used for age-adjusted rate.

Trends of age-adjusted cancer incidence rates were analyzed using Joinpoint regression, which fitted up to the best model on a logarithmic scale to the trends in the annual rates. Joinpoint analyses were performed using the software which is called 'Joinpoint Regression Program' from the Surveillance Research Program of the US National Cancer Institute (Kim et al., 2000).

Bayesian APC models were used to predict incidence until 2010 with specialized software (BAMP) (Schmid and Held, 2007). For fitted and projected age standardized rates, samples of 1010000 were drawn from the posterior distribution. These samples were summarized after excluding the initial 10,000 iterations as "burn-in".

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Table 1. Crude and Age-adjusted Rates for Urban and Rural: 1999-2010

Year	Urban		Rural		Urban and Rural	
	Crude rate	Age adjusted rate	Crude rate	Age adjusted rate	Crude rate	Age adjusted rate
1999-2001	7.71	5.70	1.99	1.78	6.27	4.82
2002-2004	8.95	6.40	2.60	2.18	7.33	5.43
2005-2007	9.92	6.90	3.65	3.02	8.39	6.05
2008-2010	9.89	5.27	4.69	2.79	8.76	4.75
Total	9.33	6.12	3.40	2.60	7.91	5.35

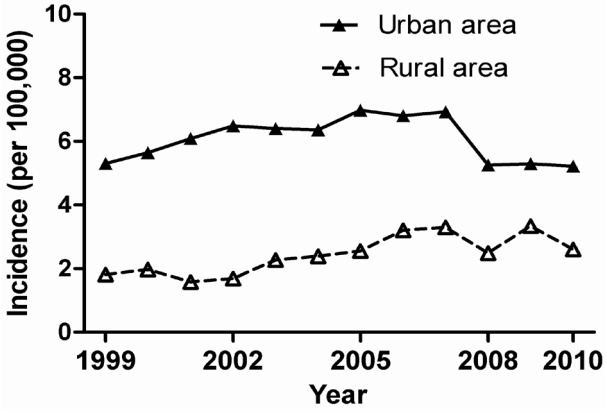

Figure 1. Time Trends of Age-adjusted Incidence Rate of Ovary Cancer in China,1999-2010

Table 3. Percent Changes in Age-specific Incidence Rates of Ovary Cancer in China

Age group	Urban areas			Rural areas		
	1999-2003	2006-2010	Change(%)	1999-2003	2006-2010	Change(%)
25-29	3.16	2.57	-18.67	0.84	1.29	53.57
30-34	2.84	2.92	2.82	1.12	1.17	4.46
35-39	4.77	4.14	-13.21	2.06	2.61	26.70
40-44	8.49	6.18	-27.21	2.35	3.39	44.26
45-49	14.60	11.07	-24.18	4.84	6.04	24.79
50-54	18.07	17.14	-5.15	6.42	9.67	50.62
55-59	17.11	20.45	19.52	4.93	10.47	112.37
60-64	17.16	20.25	18.01	6.99	11.24	60.80
65-69	19.88	20.37	2.46	4.76	10.55	121.64
70-74	20.40	20.78	1.86	2.64	8.07	205.68
75-79	17.71	20.46	15.53	3.70	9.02	143.78
80-84	15.39	20.69	34.44	1.59	6.52	310.06
85+	15.56	17.05	9.58	3.29	5.11	55.32

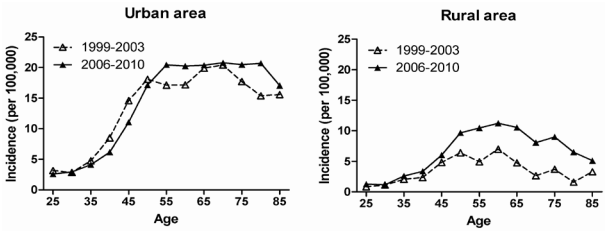

Figure 2. Age-specific Incidence Rates of Ovary Cancer in China

Table 2. Estimated Annual Percentage Changes (Eapc) from Joinpoint Analysis (China, 1999-2010)

Region	EAPC	Trend1			Trend2		
	1999-2010	Years	EAPC	95%CI	Years	EAPC	95%CI
Urban	-0.4	1999-2006	3.5*	(0.6,6.5)	2006-2010	-8.4*	(-14.4,-2.0)
Rural	5.9	1999-2010	5.9*	(2.8,9.1)			

*significantly different from 0 (P<0.05)

Results

Table 1 showed the crude and age-adjusted rates of ovary cancer. In China, the crude rate of ovary cancer was 7.91/100,000 and the age-adjusted rate was 5.35/100,000 during period 1999-2010. Both the crude and age-adjusted rates in urban area were substantially higher than that in rural area, the crude rate in urban region was 2.7 times of the rate in rural region and the age-adjusted rate was 2.4 times of that. Different trends of age-adjusted incidence rate in ovary cancer have been observed between urban and rural areas. For urban area the adjusted rate during 2008–2010 was 0.9 times of the rate observed at 1999-2001 period. For rural area the rates during 2008-2010 were 1.6 times of the rates during 1999-2001.

The age-adjusted rate of ovary cancer in urban area increased first and decreased in recent years. However the rate in rural area increased constantly over the period (Figure 1). Table 2 gives the estimated annual percentage changes (EAPC) of ovary cancer from joinpoint analysis. As presented, overall significant rise (EAPC=5.9; 95%CI: 2.8, 9.1) in age-adjusted rate was observed for rural females, but the small decrease (EAPC=-0.4) was not significant for urban females. Year 2006 was chosen as a jointpoint to separate the trend in urban area. The significant rise (EAPC=3.5; 95%CI: 0.6, 6.5) during the trend 1999-2006 and drop (EAPC=-8.4; 95%CI: -14.4, -2.0) during the trend 2006-2010 were observed.

The decreases in ovary cancer of urban area tended to be restricted to women aged 50 years and younger,

Table 4. Predicted Incidence Rates of Ovary Cancer in China

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Urban										
Crude rate	6.73	6.81	6.73	6.74	6.80	6.87	6.92	6.83	6.85	6.90
Age adjusted rate	5.25	5.19	5.03	4.94	4.88	4.83	4.76	4.59	4.49	4.44
Rural										
Crude rate	3.46	3.42	3.39	3.34	3.25	3.28	3.23	3.12	3.08	3.01
Age adjusted rate	2.66	2.57	2.48	2.39	2.28	2.25	2.15	2.04	1.94	1.84
Urban and Rural										
Crude rate	6.06	6.1	6.05	6.08	6.17	6.26	6.3	6.19	6.18	6.2
Age adjusted rate	4.7	4.64	4.51	4.43	4.4	4.38	4.3	4.14	4.05	3.97

particularly at ages 35 to 49 changed from -13 to -27 percent (Figure 2 and Table 3). In contrast, rates of urban area increased at ages older than 55 years. Although increases of ovary cancer in rural area appeared virtually in all age group, the largest proportional changes occurred in old women. Rates among women in rural area aged 50 to 85 years increased from 50 to 310 percent from the period 1999-2003 to 2006-2010.

The predicted incidence rates in China during period 2011-2020 were shown in Table 4. Although the age-adjusted incidence rate for ovary cancer was predicted to be reduced after year 2011, the crude rate was relative stable up to 2020.

Discussion

This study investigated the evolution of trends in the incidence of ovarian cancer in Chinese females of urban and rural areas during the last 12 years using data from the national cancer registry database of China. Much higher rate of ovary cancer was observed in urban area. Constant increase trend was found in rural area, however in urban area an upward trend before 2006 and a recent downward trend was conformed significant by the joinpoint regress analysis. The decrease in urban area mostly occurred at the younger women.

Ovarian cancer is relatively uncommon in China, but an increase in the incidence has been reported before. The age-adjusted rate of ovarian cancer was reported to have increased by approximately 9.5% in Shanghai, China from the period 1972-74 to 1987-89 (Jin et al., 1993). Estimates of national incidence rates showed that the incidence of ovarian cancer slightly increased between 2000 and 2005 (Kim et al., 2009).

The highest incidence rates in the world were largely confined to developed countries, such as Northern Europe, the Western Europe and Northern America. However, the incidence rates of ovary cancer in Northern Europe and the United States showed some decline trend recently, especially among younger women (Bray et al., 2005; Lowe et al., 2013).

The etiology of ovarian cancer is poorly understood and several factors, including menstrual and reproductive factors, obesity and a family history of ovarian cancer have been associated with an increased risk of ovarian cancer (Salehi et al., 2008). Many of these risk factors are highly related to habits and lifestyle practices. The trend of ovary cancer incidence in this study probably reflects varies of these habits and lifestyle practices with economic developed in China.

Bayesian APC model could give stable projections even with small numbers of data (Brennan and Bray, 2002) which make it very suitable for our study. Based on the assumption that past age, period and cohort trends would continue into the future, we made ovary cancer projections by applying the Bayesian APC model for the next 10 years in China. We found that although the age-adjusted incidence rate for ovary cancer was predicted to be reduced, the crude rate was likely to be relative stable up to 2020.

In summary, urban area of China has higher incidence rate of ovary cancer but showed a decline trend in recent years. Cancer burden of ovary cancer in China will continue to be relative stable due to the aging population. The present estimates provide basic data that are important for guiding policy-makers on issues of ovary cancer prevention and control.

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The authors declare that they have no competing interests.

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