

Incidence and mortality of corpus uteri cancer in China, 2008–2012

Yunfeng Xi^{1*}, Wenrui Wang^{1*}, Wenjie Chen¹, Ke Han¹, Liying Qiao¹, Wanqing Chen²

¹Inner Mongolia Integrative Center for Disease Control and Prevention, Hohhot 010031, China; ²National Cancer Center/National Clinical Research Center for Cancer/Cancer Hospital, Chinese Academy of Medical Science & Peking Union Medical College, Beijing 100021, China

*These authors contributed equally to this work.

Correspondence to: Wanqing Chen. National Cancer Center/National Clinical Research Center for Cancer/Cancer Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100021, China. Email: chenwq@cicams.ac.cn.

Abstract

Objective: To analyze the incidence and mortality rates of corpus uteri cancer in China using 2008–2012 data from the National Central Cancer Registry (NCCR) of China.

Methods: We analyzed 2008–2012 data from 135 cancer registries using NCCR screening methods and criteria. The Chinese standard population in 2000 and Segi's world population were applied to determine age-standardized incidence and mortality rates. The annual percentage change (APC) in rate was calculated using the Joinpoint Regression Program.

Results: The crude incidence of corpus uteri cancer was 9.58/100,000, making corpus uteri cancer the ninth most common malignancy in females. The crude mortality was 2.97/100,000, making corpus uteri cancer the 13th leading cause of death from malignant tumors in females. The incidence was higher in urban than in rural areas, but the mortality was higher in rural than in urban areas. The crude incidence was higher in eastern areas than in middle and western areas, while the crude mortality was higher in middle areas than in eastern and western areas. During 2003–2012, the age-standardized incidence rate based on the Chinese standard population in 2000 (ASIRC) with uterine cancer increased significantly by 3.0% annually, while the age-standardized mortality rate based on the Chinese standard population in 2000 (ASMRC) decreased by 0.4% annually, but the decrease was not statistically significant. The APC in incidence rate in the age groups of 30–44 years was 4.2%, which was statistically significant; increases/decreases in other age groups were not statistically significant. From 2003 to 2004, the age groups of 60–74 years showed high incidence, while from 2005 to 2012, the age groups of 45–59 years had high incidence.

Conclusions: The incidence and mortality rates of corpus uteri cancer in China from 2008 to 2012 were relatively low compared with other countries. However, the significant increase in incidence rates and marked decrease in patient age suggest the need to strengthen China's efforts toward prevention and control of corpus uteri cancer.

Keywords: China; corpus uteri cancer; incidence; mortality

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Introduction

Corpus uteri cancer is one of the most common gynecological cancers in females. In 2013, it accounted for

3.79% of cancer incidences among women in China (1). Studies have shown an increasing trend in the incidence and mortality rates of corpus uteri cancer, with the incidence in developed countries and regions exceeding

that of cervical cancer and ranking 4th among cancers in women (2). In recent decades, with the rapid socio-economic development, lifestyle changes, urbanization, and aggravated population aging in China, the incidence of corpus uteri cancer has exhibited an increasing trend, posing a serious threat to females' health. According to estimates by GLOBOCAN 2012, the age-standardized (world population-based) incidence rate and mortality rate of corpus uteri cancer in China are 8.6/100,000 and 1.9/100,000, respectively, thereby ranking corpus uteri cancer as the 9th most common malignant tumor and 13th most common cause of cancer-related death in women (2).

In the present study, we used the data collected from the National Central Cancer Registry (NCCR) of China during 2008–2012 to analyze the epidemic situation of corpus uteri cancer in tumor registration areas of China during this period. We also analyzed incidence and mortality trends of corpus uteri cancer during the 10-year period from 2003 to 2012. Our results would provide a scientific basis for the formulation of China's prevention and control strategies toward corpus uteri cancer and the evaluation of effects of such efforts.

Materials and methods

Data source and quality control

We analyzed data collected from 135 cancer registries using screening criteria formulated by the NCCR during 2008–2012. Based on "Chinese Guideline for Cancer Registration" (3) and with reference to "Cancer Incidence in Five Continents Volume IX" (4) and relevant requirements on registration quality stated by the International Agency for Research on Cancer/International Association of Cancer Registries (IARC/IACR) (5), the NCCR performs reviews and evaluations of data using database software such as MS-FoxPro, MS-Excel, SAS, and International Committee of the Red Cross (ICRC)/IACR's IARCrgTools software (6). The reliability, completeness, validity, and timeliness of the data are evaluated using several major indicators such as the percentage of cases microscopically verified (MV%), percentage of death certificate-only cases (DCO%), mortality to incidence ratio (M/I), and percentage of the diagnosis of unknown basis (UB%). The data for the present study were classified into grades A, B, and D according to the requirements of the research protocol (7,8), and grade A and B registry data

with at least 3 subsequent years of continuous data were included in the study. In the analytical data for uterine cancer, the M/I, MV%, DCO%, and UB% were 0.31, 86.86%, 1.31%, and 0.38%, respectively. In urban cancer registries, the M/I, MV%, DCO%, and UB% were 0.28, 89.48%, 1.17%, and 0.34%, respectively, while in rural cancer registries, the values were 0.38, 81.65%, 1.58%, and 0.45%, respectively (Table 1).

The 135 registries covered a population of 629,333,910 person-years (318,623,600 person-years for males and 310,710,310 person-years for females), 56 cities with a population of 382,669,450 person-years, and 79 rural areas with a population of 246,664,460 person-years. We extracted and analyzed individual tumor records for patients who were diagnosed with primary invasive cancer of the uterus [International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) codes C54-55]. National Bureau of Statistics provided overall population data for 2008–2012 by area and sex, and each year, the incidence/mortality rate of uterine cancer and the data of population during 2003–2012 were acquired from the database of NCCR.

Statistical analysis

The crude incidence and mortality rates of uterine cancer were calculated in each stratum by area (urban and rural), region (eastern, middle, and western), and age group. The Chinese standard population in 2000 and Segi's world population data were applied to determine age-standardized incidence and mortality rates (9). The annual percentage change (APC) of the rate was calculated for time trend analysis from 2003 to 2012 using the Joinpoint Regression Program (Version 4.5.0.1; Statistical Methodology and Applications Branch, Surveillance Research Program, National Cancer Institute, Rockville, MD, USA). SAS software (Version 9.4; SAS Institute Inc.,

Table 1 Quality control indices of uterine cancer in China, 2008–2012

Area	M/I	MV%	DCO%	UB%
All	0.31	86.86	1.31	0.38
Urban	0.28	89.48	1.17	0.34
Rural	0.38	81.65	1.58	0.45

M/I, mortality to incidence ratio; MV%, percentage of cases morphologically verified; DCO%, percentage of death certificate-only cases; UB%, percentage of the diagnosis of unknown basis.

Cary, NC, USA) was used for the statistical analysis. $P < 0.05$ was considered statistically significant.

Results

Incidence and mortality rates of corpus uteri cancer

Tables 2,3 show the incidence and mortality rates of corpus uteri cancer in China. There were 29,758 new cases of corpus uteri cancer, accounting for 3.81% of malignancies in female patients. The crude incidence of corpus uteri cancer was 9.58/100,000, making corpus uteri cancer the 9th most common malignant tumor in females. The age-standardized incidence rate based on the Chinese standard population in 2000 (ASIRC) and age-standardized incidence rate based on the Segi's world population (ASIRW) were 6.67/100,000 and 6.46/100,000, respectively, with a cumulative rate of 0.72% (for age group 0–74 years) (Table 2).

During 2008–2012, a total of 9,213 patients died from corpus uteri cancer, accounting for 2.20% of cancer-related deaths from malignancies in females. The crude mortality rate of corpus uteri cancer was 2.97/100,000, making this cancer the 13th leading cause of cancer-related death from

malignant tumors in females. The age-standardized mortality rate based on the Chinese standard population in 2000 (ASMRC) and that based on Segi's world population (ASMRW) were 1.91/100,000 and 1.87/100,000, respectively, with a cumulative rate of 0.21% (for age groups of 0–74 years) (Table 3).

The incidence was higher in urban areas than in rural areas. After adjustment for age, the incidence gap between different areas decreased. The ASIRC in urban areas was 1.19 times as much as in rural areas. Meanwhile, the mortality was higher in rural areas than in urban areas, showing corpus uteri cancer as the 11th and 14th leading cause of death due to malignant tumors in rural and urban areas, respectively.

The crude incidence was higher in eastern areas (10.39/100,000) than in middle areas (7.81/100,000) and western areas (7.17/100,000). After adjustment for age, the crude incidence remained higher in eastern areas than in middle and western areas. However, the crude mortality was higher in middle areas (2.99/100,000) than in eastern areas (2.96/100,000) and western areas (2.98/100,000). After adjustment for age, the crude mortality was higher in western areas (ASMRC: 2.25/100,000, ASMRW: 2.21/100,000) than in middle areas (ASMRC: 2.22/100,000,

Table 2 Incidence of corpus uteri cancer in China, 2008–2012

Areas	New cases	Crude rate (1/10 ⁵)	Ratio (%)	ASIRC (1/10 ⁵)	ASIRW (1/10 ⁵)	Cumulative rate 0–74 (%)	Rank
All areas	29,758	9.58	3.81	6.67	6.46	0.72	9
Urban areas	19,941	10.52	3.82	7.09	6.89	0.78	8
Rural areas	9,817	8.11	3.78	5.96	5.72	0.63	8
Eastern areas	22,814	10.39	3.90	6.97	6.76	0.76	9
Middle areas	5,030	7.81	3.49	6.00	5.76	0.64	8
Western areas	1,914	7.17	3.60	5.52	5.37	0.60	8

ASIRC, age-standardized incidence rate based on the Chinese standard population in 2000; ASIRW, age-standardized incidence rate based on Segi's world population.

Table 3 Mortality rate of corpus uteri cancer in China, 2008–2012

Areas	New cases	Crude rate (1/10 ⁵)	Ratio (%)	ASMRC (1/10 ⁵)	ASMRW (1/10 ⁵)	Cumulative rate 0–74 (%)	Rank
All areas	9,213	2.97	2.20	1.91	1.87	0.21	13
Urban	5,464	2.88	2.08	1.75	1.73	0.19	14
Rural	3,749	3.10	2.42	2.16	2.10	0.24	11
Eastern areas	6,494	2.96	2.09	1.79	1.76	0.20	14
Middle areas	1,924	2.99	2.45	2.22	2.15	0.24	11
Western areas	795	2.98	2.72	2.25	2.21	0.25	10

ASMRC, age-standardized mortality rate based on the Chinese standard population in 2000; ASMRW, age-standardized mortality rate based on Segi's world population.

ASMRW: 2.15/100,000) and eastern areas (ASMRC: 1.79/100,000, ASMRW: 1.76/100,000).

Age-specific incidence and mortality rates of corpus uteri cancer

The age-specific incidence of corpus uteri cancer was relatively low before 35 years old and then dramatically increased with age, reaching a peak at age of 55 years, but decreased annually thereafter, with the lowest rate at age of 85 years. The same trend was found for both urban and rural areas (Figure 1). The age-specific mortality rate of corpus uteri cancer was relatively low before 40 years old and then dramatically increased with age, reaching a peak after the age of 85 years. The same trend was observed for both urban and rural areas (Figure 2).

Trends in corpus uteri cancer incidence and mortality

The ASIRC of corpus uteri cancer increased significantly

from 2003 (5.43/100,000) to 2012 (7.38/100,000) by 3.0% per year. During the same period, the ASIRC in urban areas significantly increased by 2.4% per year, while that in rural areas significantly increased by 5.7% per year. The APC in incidence rate was considered statistically significant (Table 4).

The ASMRC of corpus uteri cancer showed a declining trend during 2003–2012; however, the APC in mortality rate was not statistically significant. In urban areas, the ASMRC remained stable. In rural areas, the ASMRC showed an increasing trend from 2003 to 2006, increasing by 8.6% per year; however, the APC in mortality rate was not statistically significant. From 2006 to 2012, the ASMRC for rural areas showed a decreasing trend, decreasing by 5.8% per year, and the APC in rate was considered statistically significant (Table 5).

Table 6 and Figure 3 present the trend in age-specific incidence rate of corpus uteri cancer in China during

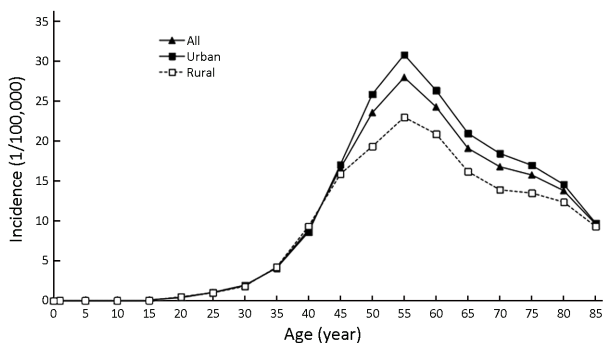


Figure 1 Age-specific incidence rate of corpus uteri cancer in China, 2008–2012.

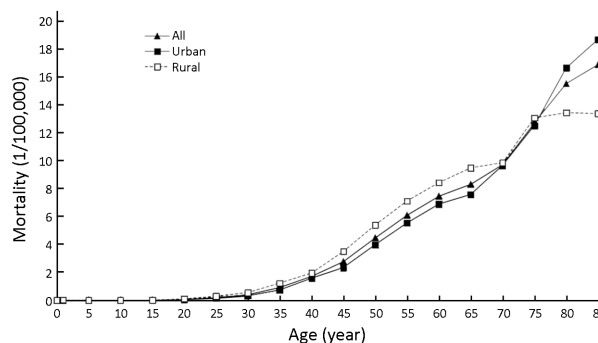


Figure 2 Age-specific mortality rate of corpus uteri cancer in China, 2008–2012.

Table 4 Trend in ASIRC of corpus uteri cancer in China, 2003–2012 (1/10⁵)

Year	Both areas	Urban areas	Rural areas
2003	5.43	6.06	3.26
2004	5.85	6.42	3.73
2005	6.17	6.81	3.68
2006	6.62	7.36	3.75
2007	6.45	7.02	4.11
2008	6.92	7.59	4.25
2009	6.42	6.91	4.46
2010	6.92	7.38	4.94
2011	7.34	7.84	5.16
2012	7.38	7.79	5.55
APC (95% CI) (%)	3.0* (2.0, 4.1)	2.4* (1.3, 3.6)	5.7* (4.8, 6.5)

ASIRC; age-standardized incidence rate based on the Chinese standard population in 2000; APC, annual percentage change; 95% CI, 95% confidence interval; *, P<0.05 was considered statistically significant.

Table 5 Trend in ASMRC of corpus uteri cancer in China, 2003–2012 (1/10⁵)

Year	Both areas	Urban areas	Rural areas
2003	1.57	1.52	1.77
2004	1.79	1.82	1.69
2005	1.99	1.98	2.04
2006	1.78	1.67	2.24
2007	1.81	1.74	2.14
2008	1.70	1.68	1.75
2009	1.60	1.56	1.77
2010	1.67	1.68	1.62
2011	1.80	1.79	1.81
2012	1.66	1.70	1.45
APC 2003–2012 (95% CI) (%)	-0.4 (-2.3, 1.4)	-0.1 (-2.1, 1.9)	-
APC 2003–2006 (95% CI) (%)	-	-	8.6 (-7.5, 27.4)
APC 2006–2012 (95% CI) (%)	-	-	-5.8* (-10.8, -0.6)

ASMRC, age-standardized mortality rate based on the Chinese standard population in 2000; APC, annual percentage change; 95% CI, 95% confidence interval; *, P<0.05 was considered statistically significant.

Table 6 Trend in age-specific incidence rate of corpus uteri cancer in China, 2003–2012 (1/10⁵)

Year	Age groups (year)				
	0–29	30–44	45–59	60–74	75+
2003	0.30	3.73	16.12	18.19	17.92
2004	0.24	3.41	19.03	20.18	14.61
2005	0.41	4.10	20.99	18.47	12.87
2006	0.37	4.80	21.96	20.17	15.10
2007	0.29	4.66	22.19	19.82	12.06
2008	0.38	4.74	23.99	21.33	14.02
2009	0.36	4.59	21.60	20.67	14.59
2010	0.37	4.80	23.45	22.02	15.21
2011	0.32	5.32	25.86	22.68	14.06
2012	0.41	5.25	25.43	23.45	13.17
APC (95% CI) (%)	2.8 (-1.3, 7.0)	4.2* (2.3, 6.2)	4.2* (2.4, 6.0)	2.5* (1.6, 3.4)	-1.3 (-4.0, 1.4)

APC, annual percentage change; 95% CI, 95% confidence interval; *, P<0.05 was considered statistically significant.

2003–2012. The APC in incidence rate was 4.2% in the age group of 30–44 years, 4.2% in the age group of 45–59 years, and 2.5% in the age group of 60–74 years, which were all statistically significant. However, the APC in incidence rate was 2.8% in the age group of 0–29 years and -1.3% in the age group of ≥75 years, all of which were not statistically significant. From 2003 to 2004, the age group of 60–74 years showed a high incidence, and from 2005 to 2012, the age group of 45–59 years had a high incidence.

The mortality rate of corpus uteri cancer remained stable for all age groups during 2003–2012 (Table 7, Figure 4).

Discussion

In 2012, corpus uteri cancer was ranked as the 6th most prevalent malignant tumor among females in the world, the 4th most prevalent malignant tumor in females in economically developed regions, and the 7th most prevalent malignant tumor in females in underdeveloped regions. With the incidence rate increasing yearly, the disease has caused serious harm to females' health. The incidence of corpus uteri cancer in 2012 was the highest in Europe (world standardized rate: 13.6/100,000), followed

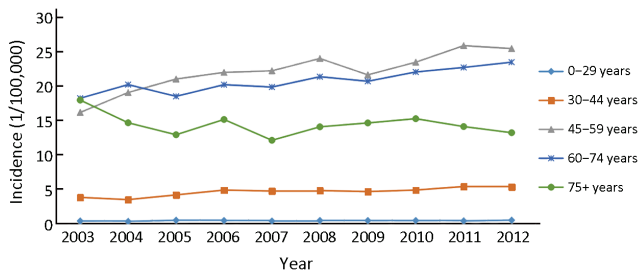


Figure 3 Trend in age-specific incidence rate of corpus uteri cancer in China, 2003–2012.

by America (world standardized rate: 12.3/100,000), Oceania (world standardized rate: 8.5/100,000), and Asia (world standardized rate: 5.9/100,000), while the lowest incidence was observed in Africa and the Mediterranean region (world standardized rate: 3.5/100,000 for both regions). When compared with neighboring countries, the incidence of corpus uteri cancer in China was lower than that of Japan and higher than that of South Korea (10). In Germany, the incidence of corpus uteri cancer accounted for 48.5% of all gynecological cancers except breast cancer (corpus uteri, ovarian, and cervical cancer), ranking corpus uteri cancer as the fourth most prevalent malignancy among women (11). Meanwhile, in China, corpus uteri cancer was ranked as the ninth most prevalent malignancy among females (1).

Around the world, the incidence rate of corpus uteri cancer in economically developed regions was found to be higher than that in underdeveloped regions. In China, the ASIRC of corpus uteri cancer was higher in urban areas than in rural areas, and was higher in eastern areas than in

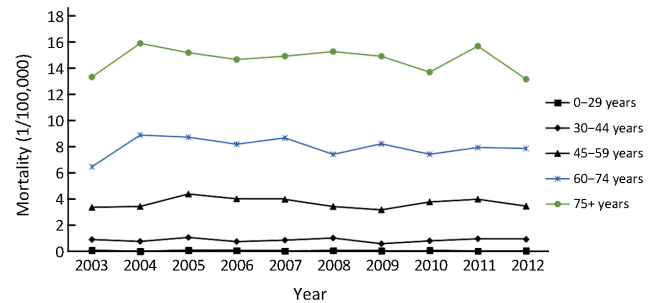


Figure 4 Trend in age-specific mortality rate of corpus uteri cancer in China, 2003–2012.

central and western areas. With the increasing rate of urbanization, the difference in population-standardized incidence rate between urban and rural areas has gradually decreased.

The global incidence of corpus uteri cancer has exhibited an upward trend. In 1999, the ASIRW of corpus uteri cancer was 5.9/100,000, which rose to 8.2/100,000 in 2008 and maintained at 8.2/100,000 in 2012. In most countries, the incidence of the disease increased (12–14), whereas in Germany and other countries, the incidence was relatively stable (15), and in the United States, the incidence decreased (16). With rapid socioeconomic development, changes in lifestyle and dietary structure of the Chinese population, urbanization, and aggravated population aging, the incidence of corpus uteri cancer in China has increased continuously, with the magnitude of annual increase in rural areas being higher than that of urban areas.

From 2008 to 2012, the incidence of corpus uteri cancer in China increased rapidly in the age group of ≥ 40 years,

Table 7 Trend in age-specific mortality rate of corpus uteri cancer in China, 2003–2012 (1/10⁵)

Year	Age groups (year)				
	0–29	30–44	45–59	60–74	75+
2003	0.08	0.90	3.36	6.47	13.34
2004	0.00	0.75	3.43	8.90	15.92
2005	0.09	1.06	4.39	8.73	15.20
2006	0.06	0.74	4.02	8.20	14.68
2007	0.02	0.85	3.97	8.68	14.93
2008	0.07	1.01	3.42	7.42	15.29
2009	0.03	0.58	3.17	8.23	14.93
2010	0.07	0.80	3.78	7.43	13.71
2011	0.02	0.96	3.98	7.94	15.70
2012	0.04	0.91	3.46	7.87	13.17
APC (95% CI) (%)	–	–0.1* (–4.8, 4.8)	–0.2* (–2.9, 2.6)	0 (–2.5, 2.6)	–0.4* (–2.1, 1.4)

APC, annual percentage change; 95% CI, 95% confidence interval; *, $P < 0.05$ was considered statistically significant.

reached a peak in the age group of ≥ 55 years, and subsequently declined, suggesting that perimenopausal females comprise the key target population for the prevention and control of corpus uteri cancer. This result is consistent with relevant domestic and foreign reports (17,18). Comparing the trends in the respective age groups from 2003 to 2012, the incidence rate in the age groups of 30–44 years and 45–59 years increased at an average annual rate of 4.2%, while the incidence rate in the age group of ≥ 75 years decreased, which indicates a marked decrease in the age of onset of corpus uteri cancer.

The mortality rate of corpus uteri cancer worldwide has increased slightly (10,19,20). In 1990, the global ASMRW was 1.7/100,000, while the corresponding figures for 2008 and 2012 were 2.0/100,000 and 1.8/100,000, respectively (12–14). The mortality rate of corpus uteri cancer continuously declined from 1980 to 2012 in Denmark (21); and declined from 2003 to 2009 in Germany (22); while it increased from 2008 to 2012 in Japan; and increased as well in South Korea (13,14). Although the mortality rate in China decreased at an annual rate of 0.4% from 2003 to 2012, the decrease was not statistically significant. Compared with the rank of corpus uteri cancer as a cause of mortality in 2003–2007 among other cancers in China (19th), the rank had significantly advanced in 2008–2012 (18th). When the mortality rates for urban and rural areas were compared, the mortality rate in the urban areas did not change significantly. For rural areas, the mortality rate increased at an average annual rate of 8.6% from 2003 to 2006, with the increase being statistically insignificant; from 2006 to 2012, the mortality declined at an average annual rate of 5.8%, with the decline being statistically significant. These findings may be related to relevant health policy changes in recent years, such as the enhancement of health resource allocation in rural areas, increase in the reimbursement ratio for the new rural cooperative medical care scheme, and the implementation of free uterine cancer screening programs in rural areas. Although the Chinese government has provided funding for relevant projects from 2008 onward and the number of registries and quality control efforts has increased over the years, there is still room for improvement in the integrity and validity of data in certain regions.

Conclusions

This study revealed that the incidence and mortality rates of corpus uteri cancer in China from 2008 to 2012 were

relatively lower than those in other countries. However, we observed a significant increase in incidence rates and a marked decrease in patient age, which suggest the need to strengthen China's efforts toward the prevention and control of corpus uteri cancer.

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Footnote

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

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