


ORIGINAL ARTICLE

Trends in incidence and mortality of esophageal cancer in Inner Mongolia, 2010–2015

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Keywords

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Thoracic Cancer **11** (2020) 2440–2448**Abstract**

Background: Esophageal cancer is among the leading cancer types in Inner Mongolia. This study aimed to investigate the incidence and mortality rates of esophageal cancer in 2015 and the trends in these rates in the 2010–2015 period in this region.

Methods: National Colorectal Cancer Roundtable (NCCR) screening methods and criteria were used to extract data from 10 cancer registries stratified by area (urban/rural), sex, and age group. The Chinese standard population in 2000 and Segi's world population were used to calculate age-standardized rates. The annual percentage change (APC) in these rates was calculated using the Joinpoint Regression Program.

Results: In 2015, Inner Mongolia had 4324 new cases (4027 male vs. 297 female patients) and 3559 deaths (3300 male vs. 259 female patients) from esophageal cancer. The crude incidence, age-standardized incidence by Chinese population, age-standardized incidence by world population, and cumulative incidence were 13.45/100 000, 9.92/100 000, 10.18/100 000, and 1.30%, respectively. The corresponding figures for mortality were 11.32/100 000, 8.35/100 000, 8.53/100 000, and 1.04%. The incidence and mortality increased with age between 40 and 80 years. The rates in rural dwellers, especially men, showed negative APC (−13.25% vs. −11.08%; $P < 0.05$).

Conclusions: The incidence and mortality rates of esophageal cancer in Inner Mongolia increased between 2010 and 2015. The rates were higher in men in rural areas, middle-aged and elderly individuals. Prevention and control programs focused on these groups, in addition to early diagnosis and treatment of esophageal cancer, are needed to reduce these rates.

Key points

Significant findings of the study: In Inner Mongolia, incidence and mortality rates of esophageal cancer were higher in urban areas than in rural areas and in men than in women between 2010 and 2015, and in middle-aged and elderly than in younger people.

What this study adds: Prevention and control programs, in addition to early diagnosis and treatment of esophageal cancer, should be tailored to specifically target men in rural areas and middle-aged and elderly individuals in order to reduce the incidence and mortality rates of this pathology.

Introduction

Esophageal cancer is a common malignant tumor worldwide, and a serious threat to human health. According to

the GLOBOCAN 2018 report, it ranked seventh in terms of the number of new cases (572 000) and sixth in terms of the number of deaths (509 000).¹ In China, the incidence

and mortality of esophageal cancer among men and women rank first in the world,² greatly reducing the quality of life and survival rate of patients, and also increasing the economic burden of tumors on society and individuals. The five-year relative survival rate of esophageal cancer in China was only 20.9%, being 19.9% in men, 23.6% in women, 19.1% in urban inhabitants, and 21.2% in individuals living in rural areas.³ Thus, it can be seen that this type of cancer has a poor prognosis, causing great pain to patients. In Inner Mongolia, the incidence and mortality rates of esophageal cancer in 2015 were 13.45/100 000 and 11.32/100 000, respectively. Both of these rates were lower than the corresponding national averages (25.13/100 000 and 19.45/100 000);⁴ however, esophageal cancer was still the fifth leading cause of death in the cancer population of Inner Mongolia. Therefore, this study used the data of cancer registration in Inner Mongolia to calculate the incidence and mortality rates of esophageal cancer in 2015 and investigate the trends of these rates from 2010 to 2015. The study results are expected to inform and assist in the prevention and control of esophageal cancer in Inner Mongolia.

Methods

Cancer registration in Inner Mongolia

In 2008, the National Program of Cancer Registries was launched by the Ministry of Health of China through a central financing mechanism. With the support of this program, population-based cancer registration has started in Inner Mongolia, establishing the Inner Mongolia Cancer Registry.

Data source and quality control

Data on the incidence and mortality rates by sex, age, and area (rural vs. urban) were extracted from the Inner Mongolia Cancer Registry Annual Report. In terms of area, countryside was assigned as a rural area, while cities as

urban areas. The data on the actual population of cancer registries were obtained from the local public security department. The National Colorectal Cancer Roundtable (NCCR) screening methods and criteria were used to analyze data from 10 cancer registries during the 2010–2015 period. In 2015, these 10 registries covered a population of 4 183 838 (16.8% of the whole area; 2 116 460 men vs. 2 067 378 women). Furthermore, the urban population comprised 2 826 627 inhabitants (61.90%; 1 426 921 men vs. 1 399 06 women) and the urban population totaled 1 603 380 individuals (38.10%; 689 539 men vs. 667 672 women).

The Inner Mongolia Cancer Registration Center reviews and evaluates data based on the “Chinese Guideline for Cancer Registration (2016)” and “Cancer Incidence in Five Continents Volume IX.”⁵ The reliability, completeness, validity, and timeliness of the data were evaluated using several major indicators, such as the percentage of microscopically verified cases (MV%), percentage of death certificate only cases (DCO%), and mortality-to-incidence ratio (M/I). The normal ranges for MV%, DCO%, and M/I are 55%–85%, 0%–20%, and 0.55–0.85, respectively. In the 2010–2015 period, the corresponding figures for esophageal cancer were 78.96%, 5.86%, and 0.73%. These figures were all in normal ranges, indicating the completeness and reliability of the data (Table 1).

Statistical analysis

Data were processed and analyzed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA) and Microsoft Excel (Redmont, WA, USA). Based on the cancer registration data in 2015, the numbers of esophageal cancer cases and deaths in Inner Mongolia were stratified by area, sex, and age group after each stratum of registry data was weighted. 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) of the rate was calculated for time trend

Table 1 Quality control indices of esophageal cancer in Inner Mongolia, 2010–2015

Year	Total			Urban			Rural		
	MV%	DCO%	M/I	MV%	DCO%	M/I	MV%	DCO%	M/I
2010	78.55	7.52	0.69	78.99	8.40	0.66	77.69	5.79	0.75
2011	77.67	9.12	0.64	75.25	11.62	0.62	81.67	5.00	0.67
2012	77.28	6.68	0.74	71.09	10.16	0.74	79.75	5.30	0.74
2013	88.37	5.81	0.73	90.16	5.74	0.67	87.66	5.84	0.75
2014	73.40	4.27	0.73	62.16	8.78	0.69	84.03	0.00	0.77
2015	78.51	1.78	0.84	69.93	3.04	0.87	88.01	0.37	0.81
Total	78.96	5.86	0.73	74.60	7.96	0.71	83.13	3.72	0.75

DCO%, the percentage of death certificate only cases; M/I, the mortality-to-incidence ratio; MV%, the percentage of microscopically verified cases.

analysis from 2010 to 2015 using the Joinpoint Regression Program, and P -values <0.05 were considered statistically significant. The probability of premature mortality, a probability index calculated based on the life table method, refers to the probability of death of a 30-year-old population due to esophageal cancer before the 70th birthday in a certain year and was calculated using the following formula: $69q_{30} = 1 - (1 - 5qx)^{70}$; $5qx$ was the probability of death in a particular age group and was calculated by the following formula: $5qx = (5mx \times 5)/(1 + 5mx \times 2.5)$, where $5mx$ was the mortality rate of that age group.⁶

Results

Incidence rates of esophageal cancer in 2015

Table 2 shows the incidence rates of esophageal cancer in Inner Mongolia. New esophageal cancer cases in cancer registries accounted for 5.29% of all malignancies (563 cases; 509 male vs. 54 female patients). Inner Mongolia was estimated to have 4324 new cases, including 4027 men and 297 women. Esophageal cancer was the seventh most common malignant tumor with a crude incidence of 13.45/100 000. The age-standardized incidence rates based on the Chinese standard population in 2000 (ASIRC) and that based on Segi's world population were 9.92/100 000 and 10.18/100 000, respectively. The cumulative rate for both sexes aged 0–74 years was 1.30%.

In Inner Mongolia, the incidence rate of esophageal cancer was higher in rural areas (19.64/100 000) than in urban areas (10.47/100 000) and also higher in men (24.04/100 000) than in women (2.61/100 000). After adjustment for age, the incidence gap between different areas decreased. The ASIRC in rural areas was 2.14 times higher than that in urban areas. In 2015, urban areas had 962 new cases of esophageal cancer (4.04% of all malignant tumors;

844 men vs. 117 women), compared to 3363 cases in rural areas (8.06%; 3183 men vs. 180 women).

Age-specific incidence rates of esophageal cancer in 2015

The age-specific incidence of esophageal cancer was relatively low among people aged <40 years. It showed a rapid upward trend at age 40–60 years and increased slowly at age 60–70 years. Then, it decreased at age 70 years, reached a peak at age 80 years, and decreased at age ≥ 85 years. At age < 60 years, the same trend was found for people indwelling both urban and rural areas; however, differences appeared thereafter. The incidence rate in urban areas fluctuated after age 60 years, reaching a peak at age 80 years and decreasing after age 80 years. However, incidence rates rose sharply after 60 years of age in rural areas, reached a peak at age 65 years, and decreased annually thereafter (Fig 1).

An increasing trend was observed among individuals aged ≥ 40 years. In both areas, the incidence rate showed a rapid increase at age 40–60 years. The increase slowed down at age 60–70 years before the incidence rate experienced some fluctuations at age 70–85 years, with a peak at age 80 years. In rural area, the incidence rate raised up exponentially from age 40 years to hit a peak at age 65 years, and then fell sharply between ages 65 and 85 years. Meanwhile, in urban areas, the rate gradually increased between ages 40 and 60 years before showing some fluctuations between ages 60 and 85 years (Fig 2).

Mortality rates of esophageal cancer in 2015

Table 3 shows the mortality rate of esophageal cancer in Inner Mongolia. In 2015, 474 patients died from esophageal cancer (7.83% of deaths from all malignancies; 426

Table 2 Incidence of esophageal cancer in Inner Mongolia, 2015

Areas	Sex	New cases	Estimated cases	Rank	Incidence (1/10 ⁵)	Ratio (%)	ASIRC (1/10 ⁵)	ASIRW (1/10 ⁵)	Cumulative rate 0–74 (%)
All	Both	563	4324	7	13.45	5.29	9.92	10.18	1.30
	Male	509	4027	5	24.04	8.61	18.69	19.27	2.49
	Female	54	297	17	2.61	1.14	1.83	1.83	0.23
Urban	Both	296	962	8	10.47	4.04	7.34	7.48	0.93
	Male	257	844	5	18.01	6.51	13.44	13.78	1.74
	Female	39	117	16	2.79	1.15	1.79	1.77	0.22
Rural	Both	267	3363	6	19.64	8.06	15.69	16.15	2.12
	Male	252	3183	3	36.49	12.82	30.11	31.04	4.07
	Female	15	180	17	2.24	1.11	1.86	1.86	0.25

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

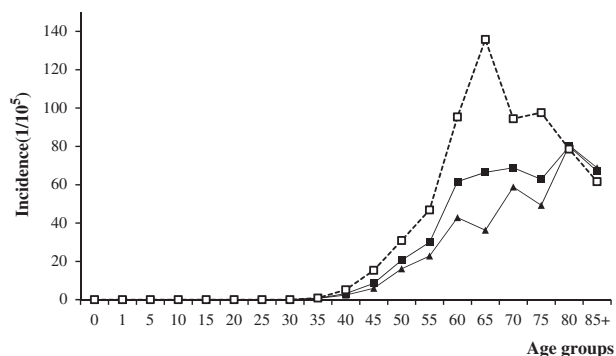


Figure 1 Region- and age-specific incidence rates of esophageal cancer in Inner Mongolia, 2015. Trends of esophageal cancer incidence in Inner Mongolia in 2015 by area (rural vs. urban) and age are shown. Among individuals aged 0–40 years in rural areas, urban areas, and both urban and rural areas, the incidence rates of esophageal cancer are low and increased from 40 years of age. Between 40 and 80 years of age, the incidence rate among rural people exceeds that among urban people and that among those living in both areas. However, this trend reverses after age 80 years. —■—, All; —▲—, Urban; - -□-, Rural.

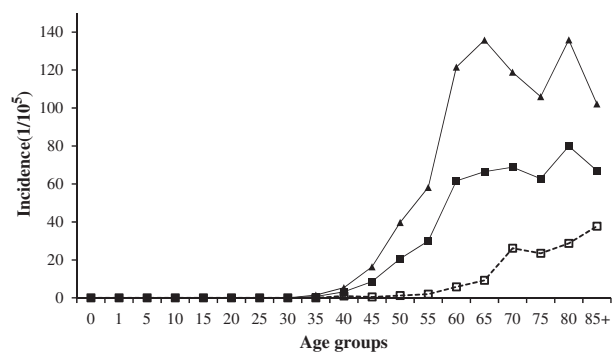


Figure 2 Sex- and age-specific incidence rates of esophageal cancer in Inner Mongolia, 2015. The rates for men, women, and both sexes are all low between 0 and 40 years of age, and increase from age 40 years. In the entire age range, the rates for men are consistently higher than those for women and for both sexes. The rate for male patients soars between 40 and 65 years old, reaching a peak at age 65 and 80 years. After age 80 years, a sharp decline can be observed. For women, the rate steadily climbs up among individuals aged ≥ 40 years. —■—, All; —▲—, Male; - -□-, Female.

men vs. 48 women). The number of deaths in Inner Mongolia was 3559, including 3300 men and 259 women. The crude mortality rate of esophageal cancer was 11.32/100 000, making this cancer the fifth leading cause of cancer-related death from malignant tumors. The age-standardized mortality rates among people aged 0–74 years based on the Chinese standard population in 2000 (ASMRC) and that based on Segi's world population (ASMRW) were 8.35/100 000 and 8.53/100 000, respectively, with a cumulative rate of 1.04%. In addition, the

probability of premature mortality due to esophageal cancer in 2015 was 0.76%.

The mortality rate of esophageal cancer was higher in rural areas (15.89/100 000) than in urban areas (9.13/100 000). After adjustment for age, the mortality gap between different areas decreased. The ASMRC in rural areas (12.82/100 000) was 2.01 times higher than that in urban areas (6.39/100 000). In 2015, urban areas had 258 esophageal cancer-related deaths (5.89% of all malignancies; 223 men vs. 35 women) and 216 in rural areas (10.59%; 203 men and 13 women) in Inner Mongolia.

Age-specific mortality rates of esophageal cancer in 2015

The age-specific mortality rates of esophageal cancer were relatively low before age 40 years, while dramatically increasing with age among people aged ≥ 40 years. It increased slowly at age 60–70 years and sharply rose again thereafter, with the peak at age 80 years (89.94/100 000). The same trend was found for both urban and rural dwellers aged 0–60 years, whereas differences appeared among those aged >60 years. In urban areas, the mortality rate increased again after a decrease at age 60–65 years. After peaking at age of 80 years (89.94/100 000), it began to decline. Conversely, in rural areas, the mortality rates rose sharply until it peaked at age 65 years (116.40/100 000) and declined thereafter. An increasing trend was observed at age 70–75 years, followed by a sharp fall (Fig 3).

The age-specific mortality rates of esophageal cancer showed increasing trends for men, women, and both sexes. However, that for men was significantly higher than that for women and that for both sexes after 40 years of age (Fig 4).

Trends of esophageal cancer incidence and mortality, 2010–2015

The ASIRC of esophageal cancer declined by 2.63% per year, from 13.12/100 000 in 2010 to 9.92/100 000 in 2015. During the same period, the ASIRC in men significantly decreased by 2.58% per year, while that in women increased by 1.50% per year. However, the APCs in these ASIRCs were not statistically significant.

The ASIRC of esophageal cancer for urban residents in general and that for urban men in particular decreased by 2.00% and 2.29% per year, respectively. The ASIRC for urban women increased by 3.17% per year. However, all of the APCs were not statistically significant. The ASIRC of esophageal cancer for rural inhabitants and that for rural men significantly decreased by 13.25% and 13.26% per year, respectively. Meanwhile, a decline was noted in the

Table 3 Mortality of esophageal cancer in Inner Mongolia, 2015

Areas	Sex	New cases	Estimated cases	Rank	Mortality (1/10 ⁵)	Ratio (%)	ASMRC (1/10 ⁵)	ASMRW (1/10 ⁵)	Cumulative rate 0–74 (%)
All	Both	474	3559	5	11.32	7.38	8.35	8.53	1.04
	Male	426	3300	4	20.12	10.28	15.69	16.09	1.98
	Female	48	259	11	2.32	2.11	1.62	1.61	0.19
Urban	Both	258	833	5	9.13	5.89	6.39	6.48	0.73
	Male	223	728	5	15.63	7.98	11.56	11.80	1.34
	Female	35	105	11	2.50	2.21	1.64	1.63	0.19
Rural	Both	216	2725	3	15.89	10.59	12.82	13.13	1.73
	Male	203	2572	3	29.40	15.07	24.70	25.36	3.33
	Female	13	154	12	1.94	1.88	1.54	1.50	0.20

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

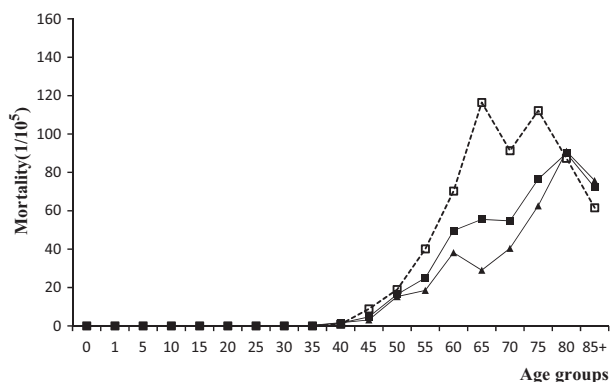


Figure 3 Region- and age-specific mortality rates of esophageal cancer in Inner Mongolia, 2015. Trends in the mortality rate of esophageal cancer in Inner Mongolia in 2015 by area and age are shown. For individuals living in both urban and rural areas, the rate shows a steady increase from age 40 years, reaching a peak at age 80 years and declining sharply after age 80 years. In the age range of 40–80 years, the rate in rural dwellers is higher than that in urban dwellers and that in those living in both urban and rural areas. However, this trend reverses after age 80 years. —■—, All; —▲—, Urban; —□—, Rural.

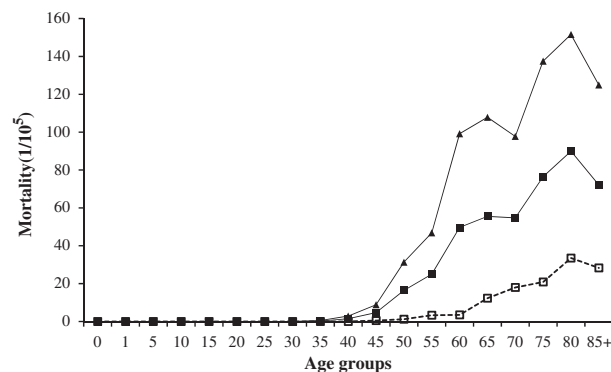


Figure 4 Sex- and age-specific mortality rates of esophageal cancer in Inner Mongolia, 2015. The mortality rate of esophageal cancer is very low in the age range of 0–40 years and increases after age 40 years. The rate for men is consistently much higher than that for women and that for both sexes. Both lines show a downward trend after age 80 years. —■—, All; —▲—, Male; —□—, Female.

ASIRC for rural women by 4.46% per year, though it was not statistically significant (Table 1).

In this study, patients included in the cancer registration area of Inner Mongolia from 2010 to 2015 were divided into five age groups: 0–29, 30–44, 45–59, 60–74, and ≥75 years. No case of esophageal cancer was found in the age group of 0–29 years in the 2010–2015 period. The incidence increased with age, especially sharply at age 45–59 years, and reached the peak at age ≥75 years. The APC in the incidence rate was –7.48%, –5.68%, –0.33%, and –2.19% in the age groups of 30–44, 45–59, 60–74, and ≥75 years, respectively. However, all of these APCs were not statistically significant (Fig 5, Table S2).

The ASMRC of esophageal cancer increased by 1.42% per year between 2010 (9.09/100 000) and 2015 (8.45/100 000). During this period, the ASMRC for men and women significantly increased by 1.32% and 9.38% per

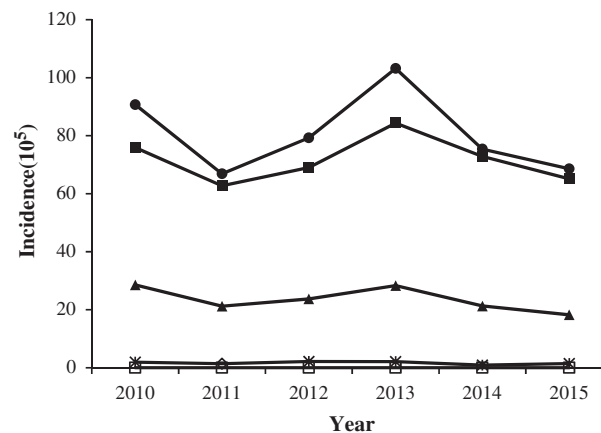
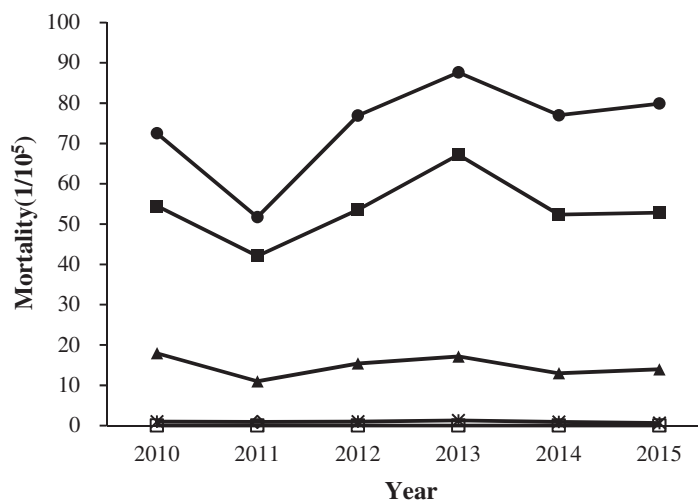


Figure 5 Trends in age-specific incidence rate of esophageal cancer in Inner Mongolia, 2010–2015. Over this period, the rates for the age groups of 0–29 and 30–44 years are 0 and relatively low, respectively, while those for the age group of 45–59 years slightly decrease. For the age groups of 60–74 and 75+ years, the rates show a sharper decrease with some fluctuations over this period and reach their peaks in 2013. —□—, 30–44; —×—, 45–59; —▲—, 60–74; —■—, 75+.

Figure 6 Trends in age-specific mortality rate of esophageal cancer in Inner Mongolia, 2010–2015. The mortality rates for the age groups of 0–29 and 30–44 years are 0 and very low, respectively, and remain almost unchanged over the five-year period. During the same period, the rates for the age groups of 45–59 and 60–74 years decline minimally, while that for the age group of 75+ years shows a slight increase. For the last two older age groups, the lowest rates can be observed in 2011, while the highest rate in 2013. ●, 30–44; ◻, 45–59; ×, 60–74; ▲, 75+.



year, respectively. However, the APCs in these ASMRCs were not statistically significant.

The ASMRC of esophageal cancer showed a tendency to increase by 2.80% per year in urban areas. The ASMRC for urban men, urban women, and both sexes all showed an upward trend. However, the APCs in the ASMRC for people living in both urban and rural areas in general and that for urban residents in particular were not statistically significant. The ASMRC for all rural dwellers and that for rural men significantly decreased by 11.08% and 11.26% per year, respectively. The ASMRC for rural women increased by 10.81% per year, but the APC in this ASMRC was not statistically significant (Table S3).

No esophageal cancer case was found in the age group of 0–29 years. Among those aged ≥ 30 years, the incidence increased with age, especially significantly at age 45–59 years, and reached a peak at age ≥ 75 years. The APC in the mortality rate were -5.51% , -1.83% , 2.11% , and 5.29% in the age groups of 30–44, 45–59, 60–74, and ≥ 75 years, respectively. However, none of these APC were statistically significant (Fig 6, Table S4).

Discussion

The incidence and mortality rates of esophageal cancer in China represent half of the global rates. The incidence rate of esophageal cancer ranked fifth in China and third in rural areas globally, after lung cancer and gastric cancer,⁷ indicating the heavy burden of this cancer.¹ The mortality rate of cancer, especially gastrointestinal cancer, is on the decline in countries where living standards have continuously improved, such as United States,^{8–10} Switzerland, Denmark, Finland,^{11–14} Korea,¹⁵ and China.¹⁶ The results of the third retrospective survey on the causes of death in China showed that the mortality rate of esophageal cancer decreased by 33.6% from the first survey and by 41.6%

from the second survey.¹⁷ Between 2003 and 2015, the five-year survival rate of patients with esophageal cancer in China increased by 2.9% per year.¹⁸ Nevertheless, the incidence and mortality rates of esophageal cancer in China is far higher than the global average level.

Since the 1970s, the incidence rate and mortality rate of esophageal cancer in China have decreased, and the standardized mortality rate has dropped more significantly.¹⁹ However, the ASIRC and ASMIC of esophageal cancer in Inner Mongolia cancer registries did not significantly change between 2010 and 2015. This demonstrates that the prevention and control of esophageal cancer in Inner Mongolia were not as effective as expected. It should be noted that among people living in rural areas, especially men, the ASIRC and ASMIC of esophageal cancer decreased by 13.26% and 11.26% per year, respectively. A possible reason for this phenomenon is that the incidence and mortality rates of esophageal cancer in rural men were relatively high. In addition, the current prevention and control measures of esophageal cancer in Inner Mongolia have played an important role in rural male population. The age-specific incidence rates showed that the aging population is also the main reason for the high incidence of esophageal cancer in Inner Mongolia. Therefore, middle-aged and elderly people should be the target populations for esophageal cancer prevention and control. In addition, in 2015, the probability of premature mortality due to esophageal cancer was 0.76% in Inner Mongolia, which was higher than that in Jinshan District of Shanghai (0.05%).²⁰ This implies there would exist a certain gap in terms of prevention and control of esophageal cancer between Inner Mongolia and economically developed areas.

According to the pathological types, esophageal cancer can be divided into esophageal adenocarcinoma (EAC) and esophageal squamous cell carcinoma (ESCC). EAC is the main type of esophageal cancer in western developed

countries, while ESCC is more prevalent in eastern developing countries such as China.²¹ The predominant risk factors for ESCC include tobacco and alcohol use, with a synergistic effect observed in individuals who use both.²² In terms of incidence and mortality, 2015, the trends in crude, standardized, and cumulative rates (0–74 years) stratified by sex (male vs. female) and residence (urban vs. rural) in Inner Mongolia were similar to those in the corresponding national rates. More specifically, the rates in men exceeded those in women, and rural dwellers had higher rates than individuals living in urban areas.^{23, 24} These differences in esophageal cancer epidemiology are largely related to the distribution of risk factors. According to the Report on Health and Population Health in Inner Mongolia Autonomous Region,²⁵ the smoking rate among male residents aged ≥ 18 years was much higher than that in their female counterparts (48.7% vs. 8.5%). Similarly, smokers in rural areas accounted for 36.3% of residents, which was higher than that in urban areas (21.8%). In terms of alcohol use, the average daily alcohol intake of male drinkers was 1.7 times that of female drinkers.

However, differences in known risk factors alone cannot fully explain the strong male predominance.²⁶ Some research suggests that sex hormones may play a protective role in the development of esophageal cancer.²⁷ This is supported by data showing a reduced risk of esophageal cancer in breast-feeding women. In addition, urban-rural differences may be caused by the differences in education level, living environment, fruits and vegetables intake, and physical activity level between urban and rural residents.²⁸ The intake of vegetables and fruits and the level of physical exercise were significantly higher in urban areas of Inner Mongolia than in rural areas.²⁴ As previous research and reports showed that men and rural dwellers have a higher burden of esophageal cancer, they should be targeted by current prevention and control programs in Inner Mongolia. In addition, more attention should be paid to individuals with a family history of upper gastrointestinal cancer, because familial clustering has been seen both in ESCC and EAC.²⁹

Early esophageal cancer often has no typical endoscopic features; more than 85% of the patients are in the middle and late stage at the time of diagnosis.³⁰ The five-year survival rate of patients with early esophageal cancer is more than 90%, while that of patients with late esophageal cancer is less than 10%.^{31–33} Therefore, early diagnosis and treatment of esophageal cancer is the key to improving the efficacy and outcome of treatment. At present, endoscopic and pathological biopsy is the gold standard for diagnosing esophageal cancer and precancerous lesions.³⁴ However, as a traumatic examination method, it might reduce the compliance of the population. Moreover, the technical skill level of endoscopists varies across different hospitals,

leading to the low detection rate of early upper gastrointestinal cancer in China and therefore lowering the curative effect. The emergence of artificial intelligence can overcome the shortcomings of endoscopy. Many previous studies conducted in China and other countries have demonstrated the advantages of artificial intelligence in the diagnosis of early esophageal cancer.^{35–36} For example, the upper gastrointestinal cancer endoscopy AI intelligent diagnosis system (GRAIDS) not only helps diagnose upper gastrointestinal tumors, but also helps junior endoscopists reach the technical skill level of experienced endoscopists.³⁷ If the AI technology can be widely used in all levels of medical institutions, it will be of great significance to improve the level of early diagnosis and treatment of upper gastrointestinal cancer in China.

There are no reports on esophageal cancer in Inner Mongolia at home and abroad, and this study reports for the first time the incidence and mortality trend of esophageal cancer in this region. However, the short time (six years) of cancer registration may be not enough to provide statistical power for the assessment of significant trends.

In conclusion, this study showed no significant change in the esophageal cancer incidence and mortality rates in Inner Mongolia between 2010 and 2015. The incidence and mortality rates of esophageal cancer in men in rural areas and middle-aged and the elderly were relatively high. Therefore, cancer prevention and control strategies in Inner Mongolia should target these populations through communication and education activities to reduce risk factors based on the characteristics of esophageal cancer in the region. Moreover, healthy lifestyles should be advocated, for example quitting smoking, limiting alcohol use, reducing salt and oil intakes, and eating more fruits and vegetables. Finally, early screening strategies should be developed for high-risk groups, considering the regional socioeconomic context, to minimize the social burden of esophageal cancer.

Acknowledgments

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Disclosure

The authors declare that they have no conflicts of interest.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

Supplementary Table 1 Trend in ASIRC of esophageal cancer in Inner Mongolia, 2010–2015 (1/10⁵)

Supplementary Table 2 Trends in age-specific incidence rate of esophageal cancer in Inner Mongolia, 2010–2015

Supplementary Table 3 Trend in ASMRC of esophageal cancer in Inner Mongolia, 2010–2015 (1/10⁵)

Supplementary Table 4 Trends in age-specific mortality rate of esophageal cancer in Inner Mongolia, 2010–2015 (1/10⁵)