

ORIGINAL ARTICLE

Esophageal cancer incidence and mortality in China, 2010Wanqing Chen¹, Rongshou Zheng¹, Siwei Zhang¹, Hongmei Zeng¹, Yaguang Fan², Youlin Qiao³ & Qinghua Zhou²¹ National Cancer Center of China, Beijing, China² Tianjin Key Laboratory of Lung Cancer Metastasis and Tumor Microenvironment, Tianjin Lung Cancer Institute, Tianjin Medical University General Hospital, Tianjin, China³ Department of Cancer Epidemiology, Chinese Academy of Medical Sciences/Peking Union Medical College, Beijing, China**Keywords**

Cancer registry; China; esophageal cancer; incidence; mortality.

CorrespondenceWanqing Chen, National Cancer Center of China, No. 17 Pan-Jia-Yuan South Lane, Chaoyang District, Beijing 100021, China.
Tel: +86 10 8778 7039
Fax: +86 10 6771 8227
Email: chenwq@cicams.ac.cnQinghua Zhou, Tianjin Key Laboratory of Lung Cancer Metastasis and Tumor Microenvironment, Tianjin Lung Cancer Institute, Tianjin Medical University General Hospital, No. 154 Anshan Road, Heping District, Tianjin 300052, China.
Tel: +86 22 6036 3013
Fax: +86 22 6036 3013
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Introduction

Esophageal cancer is a major worldwide health problem with high rates of incidence and death, as well as considerable morbidity and the burden of treatment.^{1–10} In the developed world, the incidence of esophageal adenocarcinoma (EAC) has increased dramatically over the last 30 years and now outnumbers esophageal squamous cell cancer (ESC) in some countries. Esophageal cancer was the fifth most common cancer and the fourth leading cause of cancer death in all cancer types in China in 2010.¹¹ Based on the population of cancer registration data from the National Central Cancer Registry of China, the incidence of esophageal cancer has been decreasing since the 1990s in both urban and rural areas in China. In 2009, esophageal cancer incidence was 22.14/100 000 and mortality was 16.77/100 000 in cancer registra-

Abstract

Background: The National Central Cancer Registry of China (NCCR) is responsible for cancer surveillance. Local cancer registries in each province submit data for annual publication. The incidence and mortality of esophageal cancer in China in 2010 by age, gender, and area is reported in this article.

Methods: There were data from 145 out of 219 qualified cancer registries. Esophageal cancer cases and deaths (ICD 10 code as C15) were stratified by location, gender, age, and cancer site. The 2000 Chinese census and Segi's population were used for age-standardized incidence/mortality rates. The rank in all cancer types and cumulative rate were also calculated.

Results: It was estimated that 287 632 new cases were diagnosed and 208 473 patients died from esophageal cancer in 2010 in China. Esophageal cancer incidence ranked fifth of all cancer types with a rate of 21.88/100 000. Age-standardized rates by Chinese population (CASR) and World population (WASR) for incidence and mortality were 16.71/100 000 and 16.97/100 000, respectively. The mortality of esophageal cancer ranked fourth in all cancer types with a rate of 15.85/100 000. The CASR and WASR for mortality were 11.95/100 000 and 12.02/100 000, respectively. For both incidence and mortality, the rates of esophageal cancer were much higher in men than that in women, in rural areas than in urban areas, and peaked at age 80–84.

Conclusions: Esophageal cancer is still a major cancer type in rural areas of China. Effective prevention and control should be emphasized, including health education, chemoprevention, and early detection in high-risk groups.

tion areas, which covered 72 registries and 85.47 million of the population. In 2010, as a result of the National Program of Cancer Registration, the number of registries more than doubled compared to the previous year.

In this study, esophageal cancer data were retrieved from the national database and analysed, particularly the updated statistics on incidence rates and mortalities.

Material and methods**Data source**

The National Central Cancer Registry (NCCR) of China collected cancer registration data from local cancer registries. All new cancer cases diagnosed in 2010 were reported to the cancer registries from hospitals, community health

centers and medical insurance. The number of cancer deaths was obtained from vital statistics. Population information was collected from local statistic bureaus or household register departments in local public security bureaus.

Two hundred and nineteen cancer registries covering 31 provinces submitted cancer registration data to NCCR. The overall population coverage was 205.83 million, accounting for 15.5% of the national population of China. Data classified under invasive esophageal cancer (C15) by the International Classification of Diseases (ICD) for Oncology third edition, were retrieved from the overall cancer database and analyzed. After evaluation, there were 145 cancer registries that were qualified for inclusion in the study, including 63 cities and 82 counties covering 158 403 248 of the population, and accounting for 11.86% of the national population of China.

Quality control

Based on the Guideline of Chinese Cancer Registration and the standard of data inclusion in Cancer Incidence in Five Continents Volume IX, cancer registration data were evaluated by the quality indicators of proportion of morphological verification (MV%), percentage of cancer cases identified with death certification only (DCO%), and mortality to incidence ratio (M/I).^{12–14} As the criteria of reception, an overall MV% of more than 55%, DCO% less than 20%, and M/I between 0.55–0.95 were considered reliable and acceptable.

The indicators of MV%, DCO%, and M/I ratio of 145 registries' pooled data for esophageal cancer were 76.68%, 2.31%, and 0.58 in all areas, respectively. The MV% was higher in rural areas than that in urban areas, but the MI ratio was lower in urban areas (Table 1).

Statistical analysis

Incident cases and deaths of esophageal cancer from every cancer registry were pooled and stratified by urban/rural, area (Eastern, Middle, and Western in China), gender, and for 19 age groups (0-, 1–4, 5–9, 80–84, 85 + years). The age specific rate in each group and the national population in 2010 were used for the estimates of incidences and deaths. The 2000 China census and Segi's world population were applied for age-standardized rates. The cumulative risk of developing or dying from cancer before 75 years (in the absence of competing causes of death) was calculated and presented as a percentage. Software including MS-FoxPro, MS-Excel, IARCrgTools issued by the International Agency for Research on Cancer were used for data checking. SAS software was used to sort and calculate.

Table 1 Quality control index of esophageal cancer for 145 selected registries in China, in 2010

Areas	Gender	M/I	MV%	DOC%	UB%
ALL	Both	0.74	76.68	2.31	0.58
	Male	0.74	76.88	2.45	0.56
	Female	0.75	76.21	1.97	0.65
Urban areas	Both	0.76	74.65	2.11	0.89
	Male	0.76	75.69	2.16	0.79
	Female	0.77	71.80	1.98	1.19
Rural areas	Both	0.73	78.03	2.44	0.38
	Male	0.72	77.73	2.66	0.39
	Female	0.74	78.65	1.96	0.35
Eastern areas	Both	0.76	77.36	1.94	0.48
	Male	0.75	77.77	1.94	0.46
	Female	0.78	76.36	1.93	0.52
Middle areas	Both	0.69	78.11	2.75	0.45
	Male	0.68	78.37	3.19	0.47
	Female	0.70	77.57	1.83	0.42
Western areas	Both	0.74	68.33	3.70	1.64
	Male	0.76	67.49	4.06	1.39
	Female	0.67	70.68	2.68	2.34

Results

Incidence

It was estimated that 287 632 new cases were diagnosed as esophageal cancer in 2010 with an incidence rate of 21.88/100 000, accounting for 9.30% of overall new cancer cases in China. It ranked the fifth most common cancer, following cancers of the lung, stomach, female breast, and liver. The age-standardized incidence rates by China (CASIR) population and by World population (WASIR) were 16.71/100 000 and 16.97/100 000, respectively. Among the patients aged 0–74, the cumulative incidence rate was 2.15%.

The incident rate among men (204 449 new cases with an incidence rate of 30.38/100 000) remarkably higher than that in women (83 183 cases with 12.96/100 000). Urban areas had a lower incidence rate (109 683 and 16.55/100 000) than that in rural areas (177 949 and 27.29/100 000). Among the three regions, the Eastern region had the most new cases with the least in the Western region, however, the incidence rates were similar (Table 2).

Age-specific incidence rates of esophageal cancer were relatively low in subjects under 55 years of age and dramatically increased after 55 years of age, reaching a peak for subjects 80–84 years old (143.65/100 000). This trend was observed in men, however, in women the highest incidence rate occurred in the age group 75–79 years. In general, age specific incidence rates were significantly higher in men than that in women and lower in urban than that in rural areas (Table 3, Fig 1).

Table 2 Estimated esophageal cancer incidence by gender and area in China, 2010

Areas	Gender	No. of cases	Crude rate (1/10 ⁵)	Ratio (%)	ASRcn (1/10 ⁵)	ASRwld (1/10 ⁵)	Cumulative rate 0–74 (%)	TASR 35–64 (1/10 ⁵)	Rank
ALL	Both	287 632	21.88	9.30	16.71	16.97	2.15	26.62	5
	Male	204 449	30.38	11.31	24.05	24.42	3.07	39.35	4
	Female	83 183	12.96	6.47	9.46	9.60	1.21	13.46	6
Urban areas	Both	109 683	16.55	6.45	11.50	11.68	1.46	17.45	6
	Male	81 167	23.92	8.32	17.31	17.58	2.18	27.45	5
	Female	28 516	8.81	3.94	5.76	5.83	0.72	7.03	7
Rural areas	Both	177 949	27.29	12.77	23.10	23.49	3.01	37.39	4
	Male	123 282	36.95	14.81	32.40	32.96	4.21	53.47	4
	Female	54 667	17.17	9.74	13.97	14.21	1.82	20.96	4
Eastern areas	Both	116 152	21.12	9.04	15.93	16.19	2.07	24.59	6
	Male	81 942	29.11	11.23	22.94	23.36	2.96	37.11	4
	Female	34 210	12.74	6.16	9.05	9.15	1.17	11.68	5
Middle areas	Both	93 298	22.08	9.26	16.94	17.17	2.18	26.65	5
	Male	64 502	29.92	11.08	23.66	23.96	3.02	37.57	4
	Female	28 796	13.92	6.77	10.32	10.45	1.32	15.38	7
Western areas	Both	78 182	22.83	9.77	17.70	18.01	2.26	29.99	5
	Male	58 005	32.97	11.69	26.35	26.74	3.33	45.36	4
	Female	20 177	12.12	6.63	9.03	9.26	1.17	13.95	6

ASRcn, Age-standardised rate (China standard population, 2000); ASRwld, Age-standardised rate (World standard population); TASR, Truncated age-standardised rate (World standard population).

Mortality

Nearly 208 473 patients died of esophageal cancer in 2010 in China with a mortality rate of 15.85/100 000, accounting for 10.65% of overall cancer deaths. It ranked the fourth most fatal cancer following cancers of the lung, liver, and stomach.

The age-standardized mortality rates by China (CASMR) population and by World population (WASMR) were 11.95/100 000 and 12.02/100 000, respectively. Among the patients aged 0–74, the cumulative mortality rate was 1.44%.

As with the incidence rate, esophageal cancer deaths were much higher in men (148 865 deaths with mortality of 22.12/

Table 3 Age-specific incidence rates of esophageal cancer in China, 2010 (1/10⁵)

Age group	All areas			Urban			Rural		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
All	21.88	30.38	12.96	16.55	23.92	8.81	27.29	36.95	17.17
0–	0.04	0.08	0.00	0.07	0.13	0.00	0.00	0.00	0.00
1–	0.01	0.02	0.00	0.02	0.03	0.00	0.00	0.00	0.00
5–	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10–	0.03	0.05	0.00	0.00	0.00	0.00	0.06	0.11	0.00
15–	0.02	0.04	0.00	0.00	0.00	0.00	0.03	0.07	0.00
20–	0.05	0.02	0.08	0.07	0.00	0.15	0.03	0.03	0.03
25–	0.20	0.30	0.10	0.18	0.35	0.00	0.22	0.26	0.18
30–	0.35	0.37	0.33	0.28	0.26	0.30	0.41	0.46	0.35
35–	1.41	2.16	0.63	0.85	1.36	0.32	1.88	2.82	0.89
40–	5.01	7.38	2.54	3.15	4.63	1.63	6.83	10.03	3.45
45–	12.34	19.39	5.04	8.33	14.03	2.60	16.33	24.56	7.53
50–	28.30	42.92	12.94	18.19	30.39	5.42	38.76	55.84	20.75
55–	53.96	80.02	27.37	34.34	54.01	13.98	77.48	111.69	43.16
60–	88.86	127.89	48.48	59.67	90.68	26.89	126.31	176.81	75.50
65–	109.88	153.88	65.04	77.19	110.72	42.00	153.37	213.32	94.65
70–	130.10	180.36	80.40	90.26	129.11	50.86	180.39	246.90	116.65
75–	142.29	197.55	92.79	102.74	149.33	61.80	193.32	258.33	133.61
80–	143.65	212.41	89.19	110.57	166.25	69.03	188.03	269.76	117.97
85–	125.21	180.61	92.05	105.19	158.19	75.38	152.20	208.23	115.77

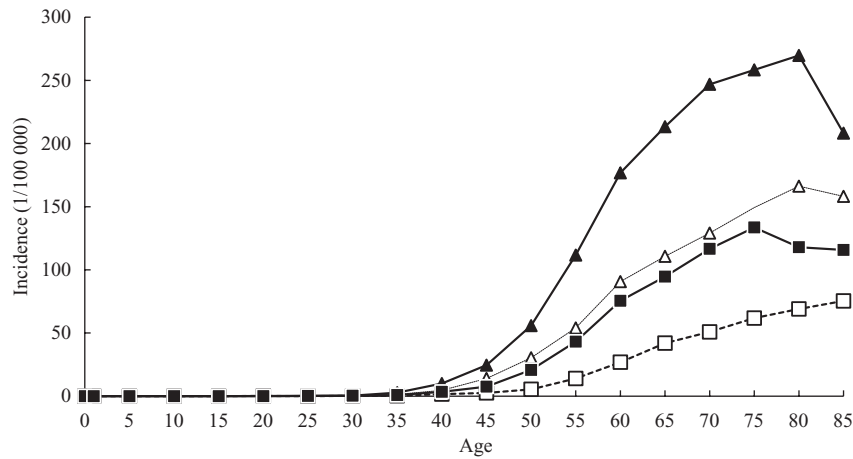


Figure 1 Age-specific incidence rate of esophageal cancer in China, 2010 (1/10⁵). —△—, urban male; ---□---, urban female; —▲—, rural male; —■—, rural female.

100 000) than that in women (59 608 deaths and 9.29/100 000). Urban areas experienced lower mortality (80 798 and 12.19/100 000) than that of rural areas (127 675 and 19.58/100 000). Among the three regions, the Eastern had the most deaths, with the least in Western region, however, the Western region had the highest mortality (Table 4).

Age-specific mortalities of esophageal cancer were relatively low in subjects under 50 years of age and dramatically increased after 50 years of age, reaching a peak for subjects in the oldest age group (85 years and over) in all areas, urban and rural women. However, the highest mortalities were observed

in the age group of 80–84 in rural both genders, and rural men. Age specific mortalities were significantly higher in men than that in women and lower in urban than that in rural areas (Table 5, Fig 2).

Discussion

NCCR has published cancer statistics in cancer registration areas in China since 2005.^{15–17} In 2010, 219 registries submitted cancer registration data to NCCR under the requirement of the National Program. This data coverage was the highest

Table 4 Estimated esophageal cancer mortality by gender and area in China, 2010

Areas	Gender	No. of cases	Crude rate (1/10 ⁵)	Ratio (%)	ASRcn (1/10 ⁵)	ASRwld (1/10 ⁵)	Cumulative rate 0–74 (%)	TASR 35–64 (1/10 ⁵)	Rank
ALL	Both	208 473	15.85	10.65	11.95	12.02	1.44	15.31	4
	Male	148 865	22.12	11.87	17.54	17.69	2.11	23.61	4
	Female	59 608	9.29	8.49	6.52	6.53	0.75	6.74	4
Urban areas	Both	80 798	12.19	7.81	8.35	8.44	1.01	10.27	5
	Male	60 544	17.84	9.27	12.90	13.10	1.57	17.01	4
	Female	20 254	6.26	5.31	3.90	3.90	0.44	3.25	6
Rural areas	Both	127 675	19.58	13.85	16.43	16.48	1.96	21.23	4
	Male	88 321	26.47	14.70	23.30	23.41	2.80	31.43	4
	Female	39 354	12.36	12.27	9.79	9.81	1.13	10.81	4
Eastern areas	Both	86 549	15.74	10.59	11.62	11.67	1.40	14.20	4
	Male	60 538	21.51	11.75	16.90	17.01	2.03	22.19	4
	Female	26 011	9.69	8.60	6.56	6.55	0.76	5.96	4
Middle areas	Both	63 549	15.04	10.34	11.43	11.42	1.30	13.75	4
	Male	43 932	20.38	11.15	16.26	16.31	1.86	20.20	4
	Female	19 617	9.48	8.90	6.77	6.73	0.74	7.11	4
Western areas	Both	58 375	17.05	11.13	13.12	13.33	1.66	19.18	4
	Male	44 395	25.24	12.86	20.14	20.46	2.54	30.31	4
	Female	13 980	8.40	7.80	6.13	6.23	0.76	7.58	6

ASRcn, Age-standardised rate (China standard population, 2000); ASRwld, Age-standardised rate (World standard population); TASR, Truncated age-standardised rate (World standard population).

Table 5 Age-specific mortality of esophageal cancer in China, 2010 (1/10⁵)

Age group	All areas			Urban			Rural		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
All	15.85	22.12	9.29	12.19	17.84	6.26	19.58	26.47	12.36
0–	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1–	0.01	0.00	0.03	0.00	0.00	0.00	0.03	0.00	0.07
5–	0.04	0.00	0.08	0.00	0.00	0.00	0.09	0.00	0.19
10–	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15–	0.01	0.02	0.00	0.00	0.00	0.00	0.02	0.03	0.00
20–	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.03	0.00
25–	0.14	0.20	0.07	0.18	0.29	0.07	0.10	0.13	0.07
30–	0.27	0.29	0.26	0.20	0.25	0.14	0.33	0.32	0.35
35–	0.97	1.53	0.39	0.55	0.80	0.30	1.32	2.14	0.47
40–	2.43	3.78	1.01	1.45	2.49	0.39	3.38	5.03	1.64
45–	6.99	11.66	2.15	4.52	8.12	0.90	9.45	15.09	3.43
50–	15.53	24.60	6.00	10.27	18.21	1.96	20.97	31.19	10.20
55–	31.60	49.23	13.60	21.63	35.91	6.84	43.55	65.45	21.57
60–	52.08	77.50	25.77	35.34	56.00	13.50	73.56	105.77	41.14
65–	75.48	111.04	39.25	59.88	91.13	27.08	96.24	138.45	54.89
70–	101.75	142.04	61.89	68.85	100.15	37.10	143.27	196.44	92.31
75–	132.58	184.00	86.52	87.82	127.91	52.59	190.33	254.68	131.22
80–	160.84	227.27	108.23	111.83	160.43	75.56	226.60	310.31	154.84
85–	162.44	237.23	117.67	124.12	194.81	84.37	214.09	289.47	165.08

to date in China. When the International Agency for Research on Cancer/International Association of Cancer Registry (IARC/IACR) called for data collection from all over the world, China submitted population based cancer registration data from 26 registries for the publication of Cancer Incidence in Five Continents, Volume 10. Finally, 12 registries' data were qualified based on the criteria from IACR and contributed to the publication (<http://ci5.iarc.fr/CI5-X/ci5-X.htm>). Recently, the national program pushed this work forward both in the increase of coverage and the improvement in data quality.

The results showed that the estimated incidences of esophageal cancer were 287.6 thousand (incidence rate of 21.88/100 000) and deaths were 208.5 thousand (mortality of 15.85/100 000) in 2010. It still ranked the fifth in incidence and fourth in mortality of all cancer types. Compared to the 2009 data, both incidence and mortality were slightly lower;⁴ however, the coverage of registries dramatically changed in this time. Recently, the establishment of registries has focused on rural areas because of the unbalanced distribution between urban and rural areas; rural populations accounted for a small percentage in the data compared to the reality. We used

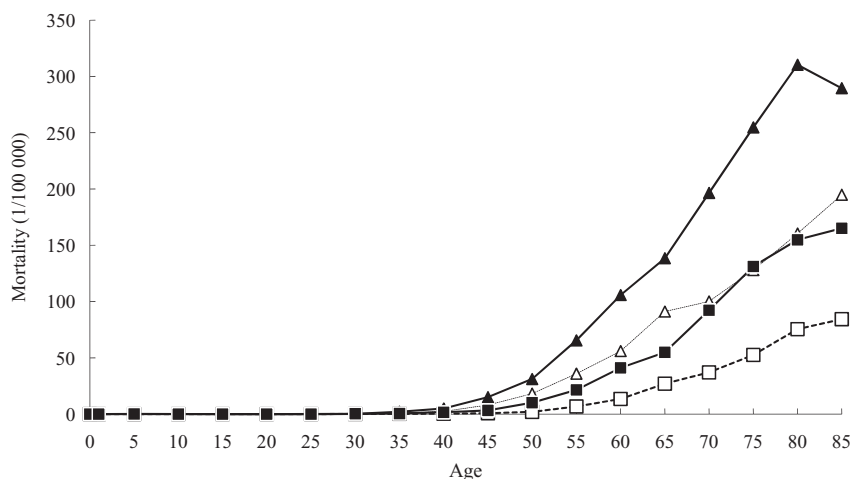


Figure 2 Age-specific mortality of esophageal cancer in China, 2010 (1/10⁵). —△—, urban male; ---□---, urban female; —▲—, rural male; ---■---, rural female.

regional stratification in this study. Finally, national estimates of incidence and mortality were calculated using the age specific rate in each group and the national population in 2010.

This time trend analysis has shown that the incidence of esophageal cancer has continued to decrease after adjusted by age since the late 1990s.¹⁸ However, as the ageing population increases, the number of new cases of esophageal cancer is also predicted to increase.¹⁸

Conclusion

The prevention and control of esophageal cancer was identified as a priority as a result of its status as a major type of cancer in China, particularly in rural areas. A focus on early detection and treatment comparable to other major cancer types, including stomach, cervical, breast, and liver cancer, has led to a breakthrough of the cancer screening program in China, especially in rural areas. Program sites of esophageal cancer have spread to more than 100 and nearly half a million people considered high-risk are screened every year, undoubtedly contributing to the decreasing rate of esophageal cancer mortality in China.

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Disclosure

No authors report any conflict of interest.

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