

Incidence and mortality of laryngeal cancer in China, 2011

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Objective: Laryngeal cancer is the common cancer of the upper aerodigestive tract. We aimed to use the national cancer registration data in 2011 to estimate the incidence and mortality of laryngeal cancer within China.

Methods: Comparable, high-quality data from 177 population-based cancer registries were qualified for analysis. The pooled data were stratified by area, sex and age group. National new cases and deaths of laryngeal cancer were estimated using age-specific rates and national population in 2010. All incidence and death rates were age-standardized to the 2000 Chinese standard population and Segi's population, which were expressed per 100,000 populations.

Results: All 177 cancer registries covered a total of 175,310,169 population (98,341,507 in urban and 76,968,662 in rural areas), accounting for 13.01% of the national population. The data 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) were 77.98%, 2.62% and 0.55, respectively. Estimated 20,875 new cases of laryngeal cancer were diagnosed and 11,488 deaths from laryngeal cancer occurred in China in 2011. The crude incidence rate of laryngeal cancer was 1.55/100,000 (2.69/100,000 in males and 0.35/100,000 in females). Age-standardized incidence rates by Chinese standard population (ASIRC) and by world standard population (ASIRW) were 1.13/100,000 and 1.14/100,000, respectively. Laryngeal cancer is much rarer in females than in males. The incidence rate was higher in urban areas than that in rural areas. The crude mortality rate of laryngeal cancer was 0.85/100,000 (1.42/100,000 in males and 0.25/100,000 in females). Age-standardized mortality rates by Chinese standard population (ASMRC) and by world standard population (ASMRW) were both 0.61/100,000. The mortality rate in males was much higher than that in females. There was no definite difference in mortality rates of laryngeal cancer between urban and rural areas.

Conclusions: Larynx is a specialized area and cancer of larynx significantly affects the quality of life for the patients. Comprehensive measures should be carried out to prevent the ascent of laryngeal cancer.

Keywords: Laryngeal cancer; cancer registry; incidence; mortality; epidemiology; China

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Introduction

Cancer of larynx was the second most common cancer in head and neck following oral cavity cancer, as well as the second most frequently cancer occurred in respiratory tract except lung cancer (1,2). According to GLOBOCAN 2012, there were an estimate of 156,877 new cases and 83,376 deaths in the world, and the adjusted incidence and mortality rates were 2.1/100,000 and 1.1/100,000, respectively. However, nearly 12.76% of global laryngeal cancer cases and 14.65% of cancer deaths occur in China owing to the huge population (3). Larynx is a specialized area and involved in breathing, sound production, and protecting the trachea against food aspiration. Cancer of larynx significantly affects the quality of life and causes serious disease burden to public health in the long run. In this article, we provided the estimated numbers of new cases and deaths of laryngeal cancer in 2011 in China, as well as a comprehensive overview of cancer incidence, mortality and cumulative risk of developing or dying from cancer before 75 years of age using the most current population-based data available.

Material and methods

Data source

Laryngeal cancer incidence and mortality data in 2011 were obtained from the National Central Cancer Registry of China (NCCR). The NCCR compiled and reported long-term, high-quality incidence, mortality and survival data submitted by local population-based cancer registries. The cancer information was collected by local hospitals, community health centers, the Basic Medical Insurances for urban residents, the New-rural cooperative medical system and so on. The Vital Statistical Database was linked with the cancer incidence database for identifying cases with death certificate only (DCO) and follow-up. By June 1, 2014, a total of 234 cancer registries from 31 provinces submitted cancer data of 2011. The population coverage was 221,390,275, accounting for 16.43% of the national population. All cancer cases were coded according to the International Classification of Diseases for Oncology, 3rd edition (ICD-O-3) and the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10). Invasive cases of laryngeal cancer (ICD10: C32) were extracted and analyzed from the overall cancer database.

National population estimates

The national population in 2011 was estimated based on the fifth National Population Census data [2000], taking into account of the changes of age composition, gender ratio and the proportion of urban and rural transformation. The national population was stratified by area (urban/rural), sex (male/female) and age groups (0-, 1-4, 5-84 by 5 years, 85+ years). The changes of age-specific death probability were also adjusted when calculating population. Linear changes were assumed in each age group between the fifth and sixth Population Census.

Quality control

The NCCR assessed quality and comparability of data using standard criteria, which were based on "Guideline for Chinese Cancer Registration" and referring to relevant data quality criterion of "Cancer Incidence in Five Continents Volume IX" by International Agency for Research on Cancer (IARC) (4,5). Proportion of morphological verification (MV%), percentage of cancer cases identified with DCO%, mortality to incidence ratio (M/I) as well as percentage of uncertified cancer (UB%) were used to evaluate the completeness, validity and comparability of data quality (6). Only datasets meeting defined quality criteria were included in this study.

Statistical analysis

The pooled data were stratified by area (urban/rural), sex (male/female), and age groups (0-, 1-4, 5-84 by 5 years, 85+ years). We estimated the numbers of new cases and deaths of laryngeal cancer in 2011 in China, as well as a comprehensive overview of cancer incidence, mortality and cumulative risk of developing or dying from cancer before 75 years of age. The Chinese population in 2000 and World Segi's population were used for age-standardized rates. Software including MS-Excel and IARCcrgTools (2.05, Ferly, IARC/IACR) was used for data checking and evaluation (4). SAS 9.2 (SAS Institute Inc., Cary, USA) software was used to calculate the incidence and mortality rates.

Results

Data quality

After clearance and assessment, data from 177 population-based cancer registries (77 in urban and 100 in rural

areas) were included for analysis. They covered a total of 175,310,169 populations (98,341,507 in urban and 76,968,662 in rural areas) including 88,655,668 males and 86,654,501 females and representing 13.01% of the national population. The data quality indicators of MV%, DCO% and M/I ratio were 77.98%, 2.62% and 0.55, respectively. The quality evaluation is presented in *Table 1*.

Incidence and mortality of laryngeal cancer

Incidence

There was an estimate of 20,875 new cancer cases of larynx diagnosed in China in 2011, accounting for 0.62% of all new cancer cases. The crude incidence rate was 1.55/100,000

(2.69/100,000 in males and 0.35/100,000 in females). The age-standardized incidence rates were 1.13/100,000 by Chinese population (ASIRC) and 1.14/100,000 by world population (ASIRW), respectively. Among the patients aged 0-74 years old, the cumulative incidence rate was 0.14%. The incidence rate in males was 8.46 times higher than that in females. The incidence rate in urban areas was higher than that in rural areas (*Table 2*).

Age-specific incidence

Laryngeal cancer incidence rate was relatively low in subjects under 44 years old. However, the rate increased dramatically in patients over 45 years old and finally peaked in subjects of 75-79 years old. The patterns of age-specific incidence rate were very similar between urban and rural areas (*Table 3* and *Figure 1*). Comparing to different areas, the male incidence rate in urban areas was higher than that in rural areas in almost all age groups, while the female incidence rate in rural areas was slightly higher than that in urban areas.

Mortality

It was estimated that about 11,488 cases died from laryngeal cancer in China in 2011, accounting for 0.54% of cancer deaths. The crude mortality rate was 0.85/100,000 (1.42/100,000 in males and 0.25/100,000 in females). The age-standardized mortality rates of Chinese population (ASMRC) and world population (ASMRW) were both 0.61/100,000. Among the patients aged 0-74 years old, the cumulative mortality rate was 0.07%. The mortality rate in males was 6.69 times higher than that in females. The mortality rate in urban areas was nearly the same as that in rural areas, but the male mortality rate was higher in urban than that in rural areas, and the female mortality rate was

Table 1 Quality control index of laryngeal cancer in China, 2011

Areas	Sex	MV%	DOC%	M/I	UB%
All	Both	77.98	2.62	0.55	0.30
	Male	79.50	2.41	0.53	0.23
	Female	65.54	4.31	0.73	0.92
Urban	Both	82.72	1.93	0.51	0.31
	Male	83.91	1.90	0.49	0.17
	Female	71.02	2.27	0.71	1.70
Rural	Both	69.43	3.86	0.63	0.28
	Male	71.12	3.39	0.61	0.33
	Female	59.06	6.71	0.75	0.00

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

Table 2 Laryngeal cancer incidence in China, 2011

Areas	Sex	Cases	Crude incidence (1/10 ⁵)	Ratio (%)	ASIRC (1/10 ⁵)	ASIRW (1/10 ⁵)	Cumulative rate 0-74 (%)
All	Both	20,875	1.55	0.62	1.13	1.14	0.14
	Male	18,583	2.69	0.97	2.03	2.06	0.26
	Female	2,292	0.35	0.16	0.24	0.24	0.03
Urban	Both	12,105	1.75	0.67	1.25	1.26	0.16
	Male	11,036	3.13	1.11	2.32	2.34	0.30
	Female	1,069	0.32	0.13	0.21	0.20	0.02
Rural	Both	8,770	1.34	0.56	0.99	1.00	0.13
	Male	7,547	2.23	0.82	1.72	1.74	0.22
	Female	1,223	0.38	0.19	0.28	0.28	0.04

ASIRC, age-standardized incidence rate (China population, 2000); ASIRW, age-standardized incidence rate (Segi's population).

Table 3 Age-specific incidence rate of laryngeal cancer in China, 2011 (1/10⁵)

Age group	All			Urban			Rural		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
All	1.55	2.69	0.35	1.75	3.13	0.32	1.34	2.23	0.38
0-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-	0.02	0.00	0.03	0.00	0.00	0.00	0.03	0.00	0.06
5-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15-	0.01	0.00	0.02	0.00	0.00	0.00	0.02	0.00	0.04
20-	0.01	0.00	0.02	0.02	0.00	0.05	0.00	0.00	0.00
25-	0.02	0.01	0.03	0.02	0.02	0.02	0.02	0.00	0.03
30-	0.05	0.09	0.01	0.01	0.03	0.00	0.10	0.17	0.04
35-	0.11	0.19	0.03	0.12	0.22	0.02	0.09	0.15	0.03
40-	0.53	0.95	0.10	0.59	1.04	0.12	0.46	0.83	0.09
45-	1.18	2.05	0.26	1.32	2.37	0.19	1.00	1.65	0.35
50-	2.73	5.00	0.33	3.28	6.18	0.17	2.01	3.43	0.54
55-	3.99	7.23	0.67	4.48	8.08	0.78	3.45	6.29	0.55
60-	5.65	10.31	0.91	5.91	11.21	0.57	5.39	9.41	1.27
65-	6.31	11.31	1.34	7.24	13.49	1.19	5.39	9.21	1.49
70-	8.12	14.46	1.99	8.82	16.74	1.48	7.37	12.11	2.55
75-	8.50	15.48	2.34	9.45	17.23	2.60	7.44	13.56	2.06
80-	7.15	13.13	2.44	7.85	13.55	3.08	6.39	12.64	1.78
85+	5.74	11.65	2.30	5.70	12.01	1.77	5.79	11.23	2.85



Figure 1 Laryngeal cancer incidence in China, 2011.

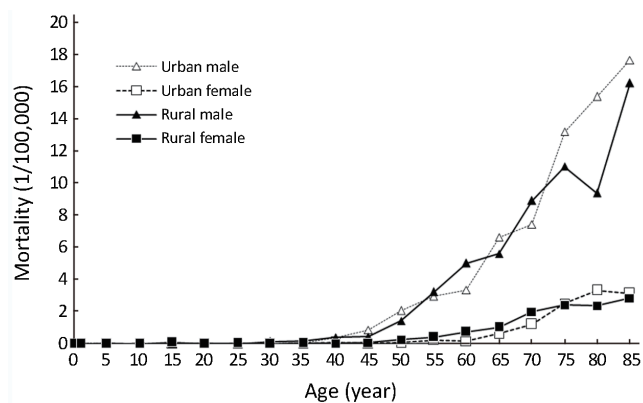
Table 4 Laryngeal cancer mortality in China, 2011

Areas	Sex	Cases	Crude mortality (1/10 ⁵)	Ratio (%)	ASMRC (1/10 ⁵)	ASMRW (1/10 ⁵)	Cumulative rate 0-74 (%)
All	Both	11,488	0.85	0.54	0.61	0.61	0.07
	Male	9,834	1.42	0.73	1.07	1.08	0.12
	Female	1,654	0.25	0.22	0.16	0.16	0.02
Urban	Both	5,971	0.86	0.56	0.60	0.59	0.07
	Male	5,236	1.49	0.78	1.09	1.09	0.12
	Female	735	0.22	0.19	0.13	0.13	0.01
Rural	Both	5,516	0.84	0.53	0.61	0.62	0.08
	Male	4,598	1.36	0.68	1.05	1.06	0.13
	Female	919	0.29	0.25	0.20	0.20	0.02

ASMRC, age-standardized mortality rate (China population, 2000); ASMRW, age-standardized mortality rate (Segi's population).

Table 5 Age-specific mortality of laryngeal cancer in China, 2011 (1/10⁵)

Age group	All			Urban			Rural		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
All	0.85	1.42	0.25	0.86	1.49	0.22	0.84	1.36	0.29
0-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-	0.01	0.03	0.00	0.03	0.06	0.00	0.00	0.00	0.00
5-	0.01	0.02	0.00	0.00	0.00	0.00	0.02	0.05	0.00
10-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15-	0.02	0.00	0.04	0.00	0.00	0.00	0.04	0.00	0.08
20-	0.01	0.02	0.00	0.00	0.00	0.00	0.02	0.03	0.00
25-	0.01	0.00	0.02	0.00	0.00	0.00	0.02	0.00	0.03
30-	0.03	0.06	0.00	0.00	0.00	0.00	0.07	0.14	0.00
35-	0.07	0.11	0.03	0.05	0.07	0.02	0.09	0.15	0.03
40-	0.23	0.40	0.06	0.25	0.39	0.09	0.22	0.40	0.03
45-	0.36	0.67	0.04	0.46	0.86	0.02	0.25	0.44	0.06
50-	0.99	1.80	0.14	1.10	2.07	0.06	0.85	1.44	0.25
55-	1.72	3.09	0.32	1.61	2.96	0.22	1.85	3.25	0.43
60-	2.34	4.20	0.45	1.77	3.37	0.16	2.92	5.04	0.75
65-	3.48	6.13	0.83	3.59	6.66	0.62	3.36	5.63	1.04
70-	4.83	8.18	1.58	4.22	7.45	1.22	5.49	8.94	1.99
75-	7.04	12.21	2.47	7.55	13.25	2.52	6.47	11.07	2.42
80-	7.17	12.64	2.86	8.85	15.44	3.33	5.36	9.41	2.38
85+	8.18	17.06	3.00	8.74	17.71	3.15	7.56	16.28	2.85

**Figure 2** Laryngeal cancer mortality in China, 2011.

higher in rural than that in urban (Table 4).

Age-specific mortality

The laryngeal cancer mortality rate was relatively low in subjects under 44 years old. The rate dramatically increased in patients over 45 years old, reaching peak in subjects over

85 years old. The patterns were very similar between urban and rural areas (Table 5 and Figure 2). The male age-specific mortality in urban areas was higher than that in rural areas in subjects over 45 years old, except the age-group of 55-64 years old and 70-74 years old. The female age-specific mortality in rural areas was higher than that in urban areas in patients under the age of 74 years old.

Discussion

In this article, we provide the estimated numbers of new cases and deaths of laryngeal cancer in 2011 in China, as well as a comprehensive overview of cancer incidence and mortality based on the pooled data from 177 population-based cancer registries. It was estimated that 20,875 new cases and 11,488 deaths of laryngeal cancer in China in 2011 with the incidence rate of 1.15/100,000 and mortality of 0.85/100,000. After adjusted by age, the incidence and mortality rates kept stable (1.13/100,000 and 0.61/100,000, respectively). Laryngeal cancer is much rarer in females than in males. The male to female sex ratio was 8.46 in China. What's more,

the mortality rate in males was 6.69 times higher than that in females. The incidence rate in urban areas was higher than that in rural areas, while the difference in mortality rate between urban and rural areas was quite modest.

Approximately half of global laryngeal cancer cases (77,505/156,877) and deaths (44,639/83,376) occurred in Asia, and China occupied 25 percent just behind India (3). However, when compared to the global epidemics of laryngeal cancer (2.1/100,000 for incidence and 1.1/100,000 for mortality), China remained at a relatively low level of both incidence and mortality (1.14/100,000 and 0.61/100,000, respectively) (3). In addition, the incidence rate of laryngeal cancer in China was lower than that in Singapore (1.7/100,000) and Korea (1.5/100,000), but closed to Japan (1.1/100,000). The mortality rate of laryngeal cancer in China was higher than that in Korea (0.5/100,000) and Japan (0.2/100,000), nearly closed to Singapore (0.6/100,000) (3). Recently, a report of cancer survival based on 21 cancer registries in 2003-2005 in China showed that the 5-year relative survival rates of laryngeal cancer for male and female larynx cancer were 52.9% and 44.4%, respectively (7). However, the corresponding survival for males was in the range from 60% to 80%, and exceeding 80% for females reported from six cancer registries within the Monitoring of Cancer Incidence in Japan (MCIJ) project in 2000-2002 (8). The poorer survival rate of laryngeal cancer might explain why China had a similar incidence but a higher mortality rate than Japan. Early laryngeal cancer is typically small and asymptomatic, and the higher mortality from laryngeal cancer in China could be mainly due to late presentation. Therefore, early detection and treatment are an important way to reduce death from laryngeal cancer.

The main risk factor for laryngeal cancer is smoking, including passive smoking (2). Wienecke *et al.* reported that 74.4% male and 65.7% female laryngeal cancer cases were caused by tobacco smoking among patients over 35 years old in Germany (9). Park *et al.* showed that 73.0% in males and 24.0% in females of laryngeal cancer were caused by tobacco smoking in Korea (10). While the corresponding proportion in males in China was much higher of 92.4% (11). Another risk factor is alcohol consumption, and particularly, the combination of smoking and alcohol consumption increases the interactional risk. Alcohol intake is more closely related to cancer of the supraglottis compared with cancers of the glottis and subglottis (12,13). The third risk factor is human papillomavirus (HPV) infection. Chinese laryngeal cancer patients have a relatively high level of HPV infection and

tend to increase over time (14).

Conclusions

Larynx is a specialized area and cancer of larynx significantly affects the quality of life for the patients. China has a relatively heavy laryngeal cancer burden, thus comprehensive strategies, including health education, health promotion, early detection and cancer screening, should be carried out to prevent the ascent of laryngeal cancer. Our work will serve as a basis for laryngeal cancer control planning, implementation and public-health policy evaluation, as well as scientific research.

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