Esophageal cancer incidence and mortality in China, 2009

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ABSTRACT

Objective: Esophageal cancer incident cases and deaths in 2009 were retrieved from national database of population based cancer registry to describe esophageal cancer burden in registration areas.

Methods: In 2012, 104 population-based cancer registries reported cancer incidence and mortality data of 2009 to Chinese National Central Cancer Registry. Total 72 registries' data met the national criteria to be pooled and analyzed. The crude incidence and mortality rates of esophageal cancer were calculated by age, gender and area. China sensus in 1982 and Segi's world population were applied for age standardized rates.

Results: The crude incidence of esophageal cancer ranked fifth in all cancer sites with rate of 22.14/100,000 (30.44/100,000 for male and 13.64/100,000 for female, 14.21/100,000 in urban and 38.44/100,000 in rural). Age-standardized rates by China population (CASR) and World population (WASR) for incidence were 10.88/100,000 and 14.81/100,000 respectively. The crude mortality of esophageal cancer ranked fourth in all cancer sites with rate of 16.77/100,000 (23.29/100,000 for male and 10.11/100,000 for female, 10.59/100,000 in urban and 29.47/100,000 in rural). The CASR and WASR for mortality were 7.75/100,000 and 10.76/100,000 respectively. For both of incidence and mortality, the rates of esophageal cancer were much higher in males than in females, in rural areas than in urban areas. The overall age-specific incidence and mortality rates showed that both rates were relatively low before 45 years old, and then gradually increased, reaching peak in age group of 80-84.

Conclusions: The burden of esophageal cancer remained high in China, especially for males in rural areas. Effective prevention and control action, such as health education, nutrition intervention and screening should be enhanced in the future.

KEY WORDS Esophageal cancer; incidence; mortality; cancer registry; China

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Introduction

Esophageal cancer is the fourth most common cause of cancer death, while the mortality rate was 15.21 per 10,000 (11.19% of the total cancer death) according to the data from The Third National Causes of Death Sampling Survey [2004-2005] (1). Esophageal cancer mortality rates have decreased somewhat over the past three decades with the improvement of its socio-economic status and lifestyle (1). However, esophageal cancer remains prevalent in rural areas and in males (2). Accurate population-based statistics of esophageal cancer are the basis for policy makers and researchers for effective cancer prevention and control.

Material and methods

Data source

National Central Cancer Registry (NCCR) of China was the governmental authority affiliated to Bureau of Disease Control, Ministry of Health, in charge of cancer data collection, evaluation and publication from population-based cancer registries nationalwide. All new cancer cases diagnosed in 2009 were reported to cancer registries from all hospitals, community health centers and the other departments, including centers of township medical insurance and the New-type Rural Cooperative Medical System. The death record database was linked and matched with cancer registration database for identifying cancer deaths and supplementing missed cases.

Until June 1st, 2012, there were 104 cancer registries (46 cities and 58 counties) from 27 provinces reporting cancer

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registration data to NCCR. The overall population coverage was 109,476,347, accounting for 8.20% of the whole population. The cancer registries coded cancer site and histology by the International Classification of Diseases (ICD) for Oncology, third edition and ICD-10. Invasive cases of esophageal cancer (C15) were retrieved from the overall cancer database and analyzed. Demographic information was provided by national statistics bureau.

Quality control

Based on "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) (3-5). Generally, data with DCO% less than 20%, an overall MV% of more than 55%, and M/I between 0.55-0.95 were considered acceptable.

Statistical analysis

Crude incidence and mortality rates of esophageal cancer were calculated stratified by sex, area and for 19 age groups (0-, 1-4, 5-9, ··· 80-84, 85+ years). China sensus in 1982 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, IARCcrgTools issued by IARC and IACR were used for data checkup. SAS software was used to calculate the incidence and mortality rates.

Results

A total of 72 population-based cancer registries with qualified cancer statistics were included in the study. The population covered by these cancer registries was 85,470,522, including 43,231,554 males and 42,238,968 females, accounting for 6.40% of the whole population. Among them, 31 registries were from urban areas, covering a total of 57,489,009 population. And 41 registries were from rural areas, covering a total of 27,981,513 population. The MV%, DCO%, and M/I ratio for the national pooled data were 50.76%, 4.88% and 0.85 respectively. In urban areas, the MV%, DCO%, and M/I ratio were 55.03%, 4.71% and 0.86 respectively. In rural areas, they were 38.68%, 5.35% and 0.84. There were 18,924 new cases diagnosed with esophageal cancer in 2009. Of them, 13,161 were males and 5,763 were females. The number of overall cancer deaths was 14,337, including 10,067 males and 4,270 females. The detailed information for the covering population, incident cases and the cancer deaths of esophageal cancer in each cancer registry was shown in Table 1.

Incidence

The crude incidence rate for esophageal cancer was 22.14/100,000 in 2009, accounting for 7.74% of overall new cancer cases. It ranked fifth most common cancers in all cancer sites following cancers of lung, stomach, colon-rectum and liver. The age-standardized rates by China (CASR) population and by World population (WASR) were 10.88/100,000 and 14.81/100,000, respectively. Among the patients aged 0-74, the cumulative incidence rate was 1.88%.

Esophageal cancer occurred more often among men than women. For males, esophageal cancer was the fifth most common cancer and the crude incidence rate was 30.44/100,000, whereas the CASR and WASR were 15.62/100,000 and 21.27/100,000 respectively. For females, esophageal cancer was the sixth most common cancer and the crude incidence rate was 13.64/100,000, where as the CASR and WASR were 6.27/100,000 and 8.59/100,000. The crude incidence rate in urban areas (ranked sixth most common cancer) was 14.21/100,000 and it was lower than that in rural areas (ranked the third most common cancer with incidence rate of 38.44/100,000). After age standardization, incidence rate in urban (6.65/100,000 for WASR) was still much lower than that in rural (20.57/100,000 for WASR) (Table 2).

Age-specific incidence rates of esophageal cancer for both genders and areas were compared. Overall, the age-specific incidence rate was relatively low in subjects before 45 years old. However, the rate was dramatically increasing for patients after 45 years old, reaching peak for subjects of 80-84 years old (129.26/100,000). For males, subjects in the age group of 85 years or more had highest age-specific rates, whereas for females, subjects in the age group of 80-84 years old had highest rates. Generally, esophageal cancer among males had a higher age-specific incidence rate than those among females except for those in small age groups (<30 years old). Similarly, the age-standardized esophageal cancer rates in rural were generally higher than that in urban areas except for subjects in small age groups (Table 3, Figure 1).

Mortality

The crude mortality rate for esophageal cancer was 16.77/100,000 in 2009, accounting for 9.29% of cancer deaths in 2009. The CASR and WASR for mortality were 7.75/100,000 and 10.76/100,000, respectively. Among the patients with age of 0-74, the cumulative rate was 1.30%.

The mortality rate of esophageal cancer was much higher in males than in females. For males, the crude rate, CASR

Table 1. Population, number of new cases and deaths of esophageal cancer in cancer registries in 2009.

Registry	Urban =1 Rural =2	Population			New cancer cases			Cancer death		
		Both	Male	Female	Both	Male	Female	Both	Male	Female
Beijing	1	7,645,186	3,859,586	3,785,600	676	532	144	586	449	137
Qianxi	2	361,312	182,138	179,174	90	78	12	48	40	8
Shexian	2	394,944	205,168	189,776	328	221	107	273	181	92
Cixian	2	634,333	322,621	311,712	688	407	281	506	311	195
Baoding	1	948,612	478,051	470,561	103	73	30	100	59	41
Yangquan	1	683,165	346,023	337,142	153	103	50	126	85	41
Yangcheng	2	383,165	192,119	191,046	357	226	131	239	159	80
Chifeng	1	1,203,006	613,725	589,281	72	62	10	57	47	10
Shenyang	1	3,497,815	1,722,976	1,774,839	331	284	47	247	208	39
Dalian	1	2,266,224	1,136,772	1,129,452	214	193	21	145	130	15
Zhuanghe	2	915,660	461,826	453,834	61	56	5	41	35	6
An'shan	1	1,471,775	731,916	739,859	120	91	29	92	84	8
Benxi	1	955,409	475,113	480,296	99	89	10	70	61	9
Dandong	1	767,011	378,794	388,217	48	39	9	39	34	5
Donggang	2	640,853	323,798	317,055	34	23	11	34	29	5
Dehui	2	943,395	479,486	463,909	28	21	7	19	13	6
Yanji	2	440,957	215,260	225,697	23	21	2	17	17	0
Daoli District,Harbin	1	713,264	351,071	362,193	69	62	7	39	35	4
Nangang District,Harbin	1	1,020,233	508,921	511,312	56	44	12	53	47	6
Shangzhi	2	616,046	314,864	301,182	51	43	8	27	24	3
Shanghai	1	6,181,334	3,084,496	3,096,838	504	351	153	521	355	166
Jintan	2	545,000	262,407	282,593	283	199	84	223	161	62
Suzhou	1	2,392,087	1,183,716	1,208,371	549	382	167	318	231	87
Haian	2	936,785	463,612	473,173	708	445	263	560	370	190
Qidong	2	1,114,951	548,805	566,146	133	89	44	136	90	46
Haimen	2	1,016,228	501,407	514,821	191	134	57	166	114	52
Lianyungang	1	886,862	452,358	434,504	141	106	35	109	76	33
Donghai	2	1,117,858	579,751	538,107	285	219	66	240	182	58
Guanyun	2	1,015,229	534,502	480,727	301	200	101	280	198	82
Chuzhou District, Huai'an	1	1,174,877	609,088	565,789	1,120	662	458	758	435	323
Huaiyin District, Huai'an	1	900,027	465,502	434,525	624	419	205	368	245	123
Xuyi	2	759,450	388,180	371,270	398	275	123	235	154	81
Jinhu	2	352,292	176,689	175,603	216	125	91	165	102	63
Sheyang	2	965,817	494,682	471,135	444	280	164	364	228	136
Jianhu	2	805,465	410,369	395,096	527	305	222	412	276	136

Table 1 (***continued***)

Table 1 (*continued*)

Registry	Urban =1 Rural =2	Population			New cancer cases			Cancer death		
		Both	Male	Female	Both	Male	Female	Both	Male	Female
Dafeng	2	724,147	363,326	360,821	348	224	124	303	204	99
Yangzhong	2	272,046	134,758	137,288	269	156	113	249	139	110
Taixing	2	1,128,840	613,199	515,641	615	386	229	518	336	182
Hangzhou	1	6,753,509	3,403,893	3,349,616	890	759	131	660	547	113
Jiaxing	1	509,367	253,819	255,548	64	55	9	54	45	9
Jiashan	2	382,475	189,692	192,783	67	49	18	64	52	12
Haining	2	653,957	322,969	330,988	74	57	17	63	52	11
Shangyu	2	771,321	383,462	387,859	139	128	11	135	119	16
Xianju	2	490,070	255,438	234,632	155	96	59	148	94	54
Feixi	2	858,895	449,882	409,013	397	299	98	220	162	58
Maanshan	1	633,477	323,834	309,643	131	98	33	115	89	26
Tongling	1	433,545	221,375	212,170	104	86	18	92	75	17
Changle	2	673,717	355,091	318,626	69	51	18	52	42	10
Xiamen	1	1,160,135	583,873	576,262	322	260	62	240	176	64
Zhanggong District, Ganzhou	1	420,759	212,159	208,600	36	32	4	31	25	6
Linqu	2	817,857	417,434	400,423	132	107	25	105	75	30
Wenshang	2	762,828	388,454	374,374	464	314	150	316	194	122
Feicheng	2	733,501	358,739	374,762	731	501	230	504	345	159
Yanshi	2	602,266	306,192	296,074	237	128	109	167	97	70
Linzhou	2	1,080,241	557,392	522,849	860	459	401	605	361	244
Xiping	2	858,002	434,899	423,103	260	145	115	190	108	82
Wuhan	1	4,832,174	2,484,622	2,347,552	435	337	98	350	288	62
Yunmeng	2	524,801	261,237	263,564	41	37	4	29	26	3
Hengdong	2	713,458	373,923	339,535	35	25	10	21	15	6
Guangzhou	1	3,968,216	2,014,580	1,953,636	302	246	56	249	208	41
Sihui	2	413,363	211,351	202,012	31	25	6	21	17	4
Zhongshan	1	1,468,391	732,333	736,058	140	127	13	120	110	10
Liuzhou	1	1,038,208	533,050	505,158	53	41	12	37	32	5
Fusui	2	444,332	236,000	208,332	17	15	2	12	11	1
Jiulongpo District, Chongqing	1	798,618	402,961	395,657	73	58	15	71	54	17
Qingyang District,Chengdu	1	534,701	277,154	257,547	70	55	15	52	44	8
Ziliujing District,Zigong	1	357,600	179,873	177,727	62	54	8	41	33	8
Yanting	2	610,103	316,499	293,604	573	366	207	478	306	172
Jingtai	2	233,609	119,953	113,656	21	19	2	17	15	2

Table 1 (*continued*)

Table 1 (*continued*)

Registry	Urban =1 Rural =2	Population			New cancer cases			Cancer death		
		Both	Male	Female	Both	Male	Female	Both	Male	Female
Liangzhou District,Wuwei	1	990,583	524,276	466,307	493	367	126	286	223	63
Xining	1	882,839	439,175	443,664	113	88	25	64	50	14
Xinyuan	2	271,944	138,895	133,049	76	52	24	45	33	12
Total		85,470,522	43,231,554	42,238,968	18924	13161	5763	14337	10067	4270

Table 2. Esophagus incidence by sex and area in registration areas in 2009.

Area	Sex	New cases	Incidence ($1/10^5$)		CASR[a] ($1/10^5$)	WASR[b] ($1/10^5$)	Cumulative rate 0-74 (%)	Rank
			Rate	%				
All areas	Both	18,924	22.14	7.74	10.88	14.81	1.88	5
	Male	13,161	30.44	9.57	15.62	21.27	2.69	5
	Female	5,763	13.64	5.39	6.27	8.59	1.09	6
Urban	Both	8,167	14.21	4.68	6.65	9.07	1.13	6
	Male	6,155	21.24	6.43	10.46	14.25	1.77	5
	Female	2,012	7.06	2.56	2.99	4.13	0.51	11
Rural	Both	10,757	38.44	15.38	20.57	27.95	3.57	3
	Male	7,006	49.18	16.78	27.22	37.05	4.69	3
	Female	3,751	27.31	13.31	13.97	19.03	2.44	3

Table 3. Age-specific incidence rates of esophageal cancer in cancer registration areas in 2009 ($1/10^5$).

Age group	All areas			Urban			Rural		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
all	22.14	30.44	13.64	14.21	21.24	7.06	38.44	49.18	27.31
0-	0.32	0.31	0.34	0.52	0.50	0.55	0.00	0.00	0.00
1-	0.04	0.07	0.00	0.00	0.00	0.00	0.10	0.18	0.00
5-	0.03	0.00	0.06	0.00	0.00	0.00	0.07	0.00	0.14
10-	0.02	0.04	0.00	0.00	0.00	0.00	0.05	0.10	0.00
15-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20-	0.04	0.08	0.00	0.04	0.07	0.00	0.05	0.09	0.00
25-	0.10	0.11	0.08	0.06	0.08	0.04	0.18	0.18	0.18
30-	0.29	0.30	0.27	0.23	0.23	0.24	0.38	0.42	0.34
35-	1.16	1.90	0.41	0.76	1.27	0.25	1.96	3.15	0.74
40-	3.75	5.97	1.49	2.46	4.29	0.59	6.36	9.33	3.31
45-	10.81	17.60	3.77	7.79	13.89	1.44	17.62	26.04	8.98
50-	26.87	42.16	11.11	17.67	31.03	3.95	50.30	70.23	29.48
55-	47.05	69.05	24.91	28.44	46.92	10.18	91.51	120.35	61.21
60-	76.78	108.85	44.60	42.92	68.08	18.27	149.91	193.69	103.68
65-	95.43	132.43	59.28	58.17	87.47	30.36	169.64	218.28	119.39
70-	114.04	159.64	72.12	67.14	101.43	36.16	226.79	295.38	161.08
75-	120.96	161.26	85.15	74.1	103.44	47.79	242.67	314.20	180.66
80-	129.26	175.08	92.90	86.2	119.83	58.86	238.22	321.77	175.85
85-	105.19	163.46	68.32	74.91	122.02	44.34	184.20	277.87	128.74

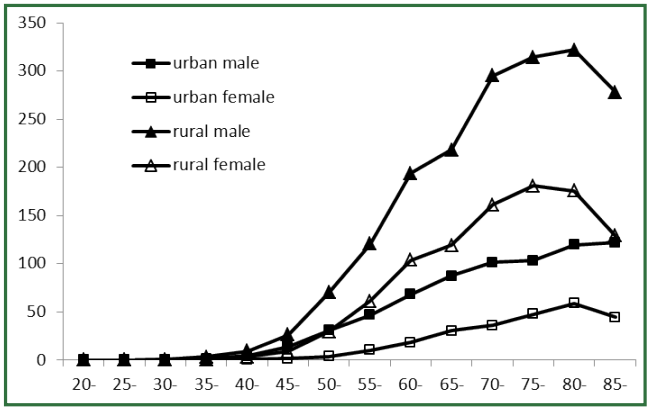

Figure 1. Age-specific incidence rate of esophageal cancer in cancer registration areas in 2009 ($1/10^5$).

and WASR were 23.29/100,000, 11.42/100,000, and 15.86/100,000. For females, the crude rate, CASR and WASR were 10.11/100,000, 4.22/100,000 and 5.96/100,000. In urban areas, the crude rate, CASR and WASR were 10.59/100,000, 4.65/100,000 and 6.47/100,000. In rural areas, they were 29.47/100,000, 14.91/100,000 and 20.69/100,000, lower than those in urban areas (Table 4).

The mortality trend for esophageal cancer in different age groups was similar to the trend of incidence. Both for males and females, in urban and in rural, the mortality reached peak for subjects of 80-84 years old. (Table 5, Figure 2).

Discussion

Cancer registry annual report provides updated cancer statistics in cancer registration areas in China (6-8). This paper analyzed incidence and mortality rates of esophageal cancer in 2009 of China, based on 72 population-based cancer registries' data. Data shown that the crude incidence and mortality rate of esophageal cancer in registration areas were 22.14/100,000 and 16.77/100,000. The age-standardized incidence and mortality rates by World population were 14.81/100,000 and 10.76/100,000. Esophageal cancer was more common in males than in females, in urban areas than in rural areas. The most recent cancer statistics on esophageal cancer might provide basic information for esophageal cancer prevention and control.

Esophageal cancer retains its status of top 4th leading cause of cancer deaths and the fifth most common diagnosed cancer in China in 2009. The incidence rate of esophageal cancer relatively increased compared the data in 2003-2007 (19.34 per 10,000) (9). The time trend shown that incidence rates of esophageal cancer had been increasing, however, after age standardization, it kept decreasing in recent 10 years (10). Aging population is a major cause for the increasing burden of esophageal cancer in China and incident cases is predicted to increase (10).

Esophageal cancer is the result of both effect of environmental factors, and lifestyle is one of the most important influencing factors (11-16). However, the exact mechanism is still not clear. The risk factors of esophageal cancer are discrepant in different countries and regions. For example, in developed country smoking, alcohol drinking and Barrett esophagitis are main risk factors (17-20), and in developing country nitrosamine, mold pollution, lack of vitamin, unhealthy lifestyles and smoking are main risk factors (14). If the genetic background can not be changed, change the bad dietary habits and behavior patterns are the most effective prevention of esophageal cancer. Hence, we should carry out health education in population in the long run, and appeal keeping away from the risk factors of esophageal cancer.

Esophageal cancer has very poor prognosis because most tumors are asymptomatic until at advanced stage which are unresectable with the intention of curing the patient. Promising results have been reported that screening with use of endoscopy may improve prognosis from esophageal cancer (21). It is expected that through primary and secondary prevention, the prevalence of the disease may be controlled in the future.

NCCR is the authoritative source of information on cancer

Table 4. Cancer mortality of esophageal cancer in cancer registration areas in 2009.

Area	Sex	Deaths	Mortality ($1/10^5$)		CASR ($1/10^5$)	WASR ($1/10^5$)	Cumulative rate	Rank
			Rate	(%)			0-74 (%)	
All areas	Both	14,337	16.77	9.29	7.75	10.76	1.30	4
	Male	10,067	23.29	10.39	11.42	15.86	1.91	4
	Female	4,270	10.11	7.44	4.22	5.96	0.70	6
Urban	Both	6,090	10.59	5.82	4.65	6.47	0.75	5
	Male	4,580	15.80	7.07	7.39	10.27	1.19	5
	Female	1,510	5.30	3.80	2.04	2.91	0.33	7
Rural	Both	8,247	29.47	16.57	14.91	20.69	2.52	4
	Male	5,487	38.51	17.06	20.57	28.55	3.45	4
	Female	2,760	20.09	15.68	9.39	13.16	1.57	3

Table 5. Age-specific mortality of esophageal cancer in cancer registration areas in 2009 ($1/10^5$).

Age group	All areas			Urban			Rural		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
all	16.77	23.29	10.11	10.59	15.80	5.30	29.47	38.51	20.09
0-	0.16	0.00	0.34	0.26	0.00	0.55	0.00	0.00	0.00
1-	0.00	0.00	0.00	0.00	0.00	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-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15-	0.04	0.07	0.00	0.06	0.11	0.00	0.00	0.00	0.00
20-	0.03	0.05	0.00	0.04	0.07	0.00	0.00	0.00	0.00
25-	0.10	0.14	0.06	0.06	0.04	0.08	0.18	0.35	0.00
30-	0.12	0.12	0.12	0.14	0.14	0.14	0.08	0.08	0.09
35-	0.61	0.84	0.38	0.47	0.61	0.33	0.90	1.29	0.49
40-	1.96	2.94	0.95	1.31	2.23	0.38	3.26	4.38	2.12
45-	5.79	9.69	1.75	4.51	8.19	0.68	8.68	13.11	4.13
50-	15.11	24.63	5.29	10.83	19.52	1.91	26.01	37.52	13.98
55-	28.29	43.14	13.35	16.39	27.46	5.45	56.72	79.47	32.82
60-	46.88	69.08	24.60	25.25	42.34	8.51	93.59	124.73	60.72
65-	67.54	99.24	36.57	39.04	59.78	19.35	124.32	174.58	72.37
70-	92.88	131.15	57.71	52.62	78.23	29.48	189.69	254.54	127.54
75-	116.43	165.97	72.40	71.59	106.39	40.37	232.88	323.57	154.27
80-	145.31	200.47	101.54	86.70	127.31	53.67	293.60	394.67	218.17
85-	139.91	207.10	97.39	96.26	151.22	60.58	253.82	361.38	190.12

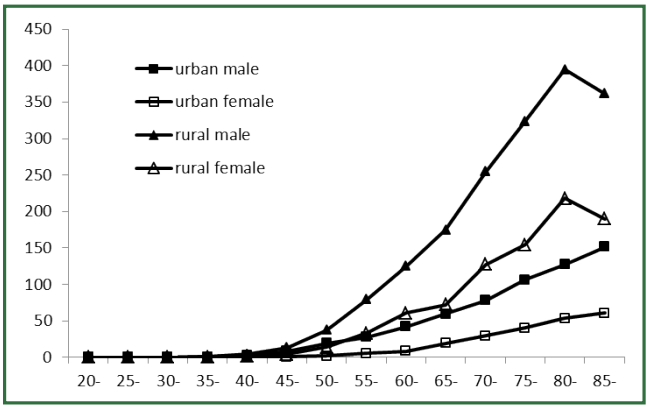

Figure 2. Age-specific mortality of esophageal cancer in cancer registration areas in 2009 ($1/10^5$).

incidence and mortality in China. NCCR collects and publishes these statistics from population-based registries. The population coverage is increasing year by year. Since 2009, the ministry of health built up more cancer registries and provided specific funding to support the development of cancer surveillance. Until the end of 2012, there were 222 cancer registries around China, covering 14% of the whole population. Notably, the new built-up cancer registries need at least 5-year time to ensure data quality and reliability.

The data provided here are the most up-to-date data on incidence and mortality, reflecting the only available population-based information on esophageal cancer of China. In our study, urban population coverage took great part in the overall population, therefore, the representativeness of the data needs to be explained with caution (22). Chinese government is still making effort to improve the quality of the cancer registration data especially in rural areas. The accuracy and representativeness of the population-based cancer statistics would be better in the future.

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