

## Brief Report

## The incidences and mortalities of major cancers in China, 2009

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## Abstract

In 2012, the National Central Cancer Registry (NCCR) of China collected cancer registration information for the year 2009 from local cancer registries and analyzed it to describe the incidences and mortalities of cancers in China. Based on the data quality criteria from NCCR, data from 104 registries covering 85,470,522 people (57,489,009 in urban areas and 27,981,513 in rural areas) were checked and evaluated. The data from 72 registries were qualified and accepted for the cancer registry annual report in 2012. The total cancer incident cases and cancer deaths were 244,366 and 154,310, respectively. The morphologically verified cases accounted for 67.23%, and 3.14% of the incident cases only had information from death certifications. The crude incidence in the Chinese cancer registration areas was 285.91/100,000 (317.97/100,000 in males and 253.09/100,000 in females). The age-standardized rates for incidences based on the Chinese standard population (ASRIC) and the world standard population (ASRIW) were 146.87/100,000 and 191.72/100,000, respectively, with a cumulative incidence of 22.08%. The cancer mortality in the Chinese cancer registration areas was 180.54/100,000 (224.20/100,000 in males and 135.85/100,000 in females). The age-standardized rates for mortalities based on the Chinese standard population (ASRMC) and the world standard population (ASRMW) were 85.06/100,000 and 115.65/100,000, respectively, and the cumulative mortality was 12.94%. Lung cancer, gastric cancer, colorectal cancer, liver cancer, esophageal cancer, pancreatic cancer, encephaloma, lymphoma, female breast cancer, and cervical cancer were the most common cancers, accounting for 75% of all cancer cases. Lung cancer, gastric cancer, liver cancer, esophageal cancer, colorectal cancer, pancreatic cancer, breast cancer, encephaloma, leukemia, and lymphoma accounted for 80% of all cancer deaths. The cancer registration's population coverage has been increasing, and its data quality is improving. As the basis of the cancer control program, the cancer registry plays an important role in directing anticancer strategies in the medium and long term. Because cancer burdens are different in urban and rural areas in China, prevention and control efforts should be based on practical situations.

**Key words** Cancer registry, incidence, mortality, epidemiology, China

Population-based cancer registries collect the data of cancer incident cases and deaths from the covered

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populations to describe and monitor cancer epidemics in certain areas. The cancer registration data are used for cancer control planning, for the implementation and evaluation of cancer prevention and control efforts, and for scientific research<sup>[1]</sup>. Since 2006, when the Disease Prevention and Control Bureau, Ministry of Health of China started to publish cancer statistics annually, the National Central Cancer Registry (NCCR) of China has been responsible for collecting data from all local registries, calculating the statistical items accurately, analyzing the data of cancer incident cases and deaths from registration areas, and releasing the updated data in the Cancer Registry Annual Report<sup>[2]</sup>. The cancer

statistical data have been broadly used in scientific studies, clinical trials, and decision-making for cancer prevention and control strategies.

## Materials and Methods

### Data source

One hundred four cancer registries from 26 provinces, including 46 urban registries and 58 rural registries, submitted cancer registration data in 2009. The coverage population of all 104 registries was 109,476,347 (55,654,485 males and 53,821,862 females), accounting for 8.20% of the entire national population by the end of 2009. The total cancer incident cases were 284,470 (160,958 males and 123,512 females), and the total number of deaths was 174,879 (110,311 males and 64,568 females).

### Quality control

The proportion of morphologic verification (MV%), the percentage of cancer cases identified by death certification only (DCO%), the mortality-to-incidence ratio (M/I), the percentage of uncertified cancer (UB%), and the percentage of cancer with undefined or unknown primary site (secondary) (O&U%) were used to evaluate the completeness, validity, and reliability of the cancer registration data. According to NCCR's acceptability criteria, the following standards should be reached: MV% higher than 66%, DCO% less than 15%, and M/I ratio between 0.6 and 0.8.

An advantage of cancer registration data is the timely reporting of cancer. However, for the completeness, validity, and reliability of cancer statistics<sup>[3]</sup>, a time gap between data updating and analysis might exist. NCCR ruled that every registry should upload the cancer registry data for 2009 before July 1, 2012, which was 30 months after the reported patients' cancer diagnoses were made.

### Statistical analysis

The quality of the data was assessed based on the "Guideline for Chinese Cancer Registration" and referred to the criteria for "Cancer Incidence in Five Continents Volume IX"<sup>[4]</sup> by the International Agency for Cancer Registry (IACR) and the International Agency for Research on Cancer (IARC), respectively. When the cancer registration data met the quality criteria for completeness, comparability, and validity, they were accepted as qualified data for analysis.

Crude incidence and mortality were calculated and age-standardized to the 1982 Chinese population and Segi's world population. The proportion and cumulative

rate were also calculated. Database software, including MS-FoxPro, MS-Excel, SAS, and IARC issued by IARC/IACR<sup>[5]</sup>, were used for data checking, evaluation, and analysis.

## Results

### Data pooling and quality evaluation

The data from 72 registries, including 31 from urban areas and 41 from rural areas, met the criteria for data quality and were pooled to create a national database in 2009. The population coverage of the valid database was 85,470,522 (43,231,554 males and 42,238,968 females), including 57,489,009 in urban areas (67.26%) and 27,981,513 in rural areas (32.74%). The total cancer incident cases and deaths were 244,366 and 137,462, respectively (Table 1).

The overall MV%, DCO%, and M/I ratio were 67.23%, 3.14%, and 0.63, respectively. They were 68.96%, 3.03%, and 0.60 in urban registries, compared with 62.91%, 3.43%, and 0.71 in rural registries.

### Incidence and mortality of all cancers

#### Incidence

The crude incidence of all cancers in the registration areas was 285.91/100,000 (317.97/100,000 in males and 253.09/100,000 in females). The ASIRC was 146.87/100,000, and the ASIRW was 191.72/100,000. Among the patients aged 0-74 years, the cumulative incidence was 22.08%. The crude and age-standardized cancer incidences in urban areas were higher than those in rural areas. Although the crude incidence in males was much higher in urban areas than in rural areas, the age-standardized incidences were similar (Table 2).

#### Mortality

The crude mortality in the cancer registration areas was 180.54/100,000 (224.20/100,000 in males and 135.85/100,000 in females). The ASMRW was 85.06/100,000, and the ASMRW was 115.65/100,000. The cumulative mortality (0-74 years) was 12.94%. Urban areas had a higher cancer mortality (181.86/100,000) than rural areas did (177.83/100,000), and both rural and urban areas had similar mortality for males. After age standardization, the mortality in rural areas was higher than that in urban areas for both males and females (Table 3).

### Incidence and mortality of major cancers

#### Cancer incidences of the 10 most common cancers

Lung cancer was the most common cancer in the

**Table 1. Distribution of cancers for the total population, new cases, and deaths in each registry in 2009**

Cancer Registry	Category 1: urban; 2: rural	Total population			New cases			Cancer deaths		
		Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
Beijing	1	7,645,186	3,859,586	3,785,600	23,339	11,784	11,555	13,544	7,969	5,575
Qianxi	2	361,312	182,138	179,174	767	503	264	421	313	108
Shexian	2	394,944	205,168	189,776	1,286	802	484	957	634	323
Cixian	2	634,333	322,621	311,712	1,866	1,064	802	1,302	825	477
Baoding	1	948,612	478,051	470,561	2,143	1,104	1,039	1,302	695	607
Yangquan	1	683,165	346,023	337,142	1,403	807	596	913	582	331
Yangcheng	2	383,165	192,119	191,046	1,272	728	544	785	504	281
Chifeng	1	1,203,006	613,725	589,281	2,051	1,186	865	1,325	797	528
Shenyang	1	3,497,815	1,722,976	1,774,839	10,801	5,598	5,203	6,891	4,051	2,840
Dalian	1	2,266,224	1,136,772	1,129,452	9,313	4,903	4,410	4,743	2,959	1,784
Zhuanghe	2	915,660	461,826	453,834	2,314	1,310	1,004	1,539	972	567
An'shan	1	1,471,775	731,916	739,859	4,724	2,434	2,290	2,958	1,791	1,167
Benxi	1	955,409	475,113	480,296	2,459	1,376	1,083	1,638	1,023	615
Dandong	1	767,011	378,794	388,217	2,389	1,282	1,107	1,636	974	662
Donggang	2	640,853	323,798	317,055	1,432	885	547	1,141	691	450
Dehui	2	943,395	479,486	463,909	1,975	1,062	913	1,182	687	495
Yanji	2	440,957	215,260	225,697	766	447	319	464	315	149
Daoli District, Harbin	1	713,264	351,071	362,193	1,953	1,069	884	1,056	638	418
Nangang District, Harbin	1	1,020,233	508,921	511,312	2,389	1,246	1,143	1,660	1,005	655
Shangzhi	2	616,046	314,864	301,182	1,254	724	530	653	410	243
Shanghai	1	6,181,334	3,084,496	3,096,838	25,366	13,321	12,045	16,933	9,840	7,093
Jintan	2	545,000	262,407	282,593	1,561	987	574	1,242	838	404
Suzhou	1	2,392,087	1,183,716	1,208,371	8,381	4,838	3,543	4,504	2,835	1,669
Haian	2	936,785	463,612	473,173	2,638	1,583	1,055	2,108	1,332	776
Qidong	2	1,114,951	548,805	566,146	3,516	2,172	1,344	2,928	1,899	1,029
Haimen	2	1,016,228	501,407	514,821	3,612	2,077	1,535	2,617	1,709	908
Lianyungang	1	886,862	452,358	434,504	1,994	1,108	886	1,306	825	481
Donghai	2	1,117,858	579,751	538,107	2,083	1,283	800	1,506	979	527
Guanyun	2	1,015,229	534,502	480,727	1,995	1,204	791	1,596	1,068	528
Chuzhou District, Huai'an	1	1,174,877	609,088	565,789	2,828	1,728	1,100	1,925	1,179	746
Huaiyin District, Huai'an	1	900,027	465,502	434,525	2,013	1,342	671	1,399	937	462
Xuyi	2	759,450	388,180	371,270	1,764	1,097	667	1,077	678	399
Jinhu	2	352,292	176,689	175,603	967	572	395	688	424	264
Sheyang	2	965,817	494,682	471,135	3,052	1,734	1,318	2,213	1,388	825
Jianhu	2	805,465	410,369	395,096	2,150	1,312	838	1,681	1,099	582
Dafeng	2	724,147	363,326	360,821	2,014	1,167	847	1,597	975	622
Yangzhong	2	272,046	134,758	137,288	1,043	576	467	873	532	341
Taixing	2	1,128,840	613,199	515,641	2,388	1,510	878	1,889	1,264	625
Hangzhou	1	6,753,509	3,403,893	3,349,616	22,625	12,690	9,935	11,592	7,571	4,021
Jiaxing	1	509,367	253,819	255,548	1,564	853	711	912	573	339
Jiashan	2	382,475	189,692	192,783	1,349	774	575	958	638	320
Haining	2	653,957	322,969	330,988	1,666	915	751	994	638	356
Shangyu	2	771,321	383,462	387,859	2,127	1,345	782	1,466	981	485
Xianju	2	490,070	255,438	234,632	1,282	813	469	998	675	323
Feixi	2	858,895	449,882	409,013	1,955	1,346	609	1,269	920	349
Maanshan	1	633,477	323,834	309,643	1,721	1,038	683	1,143	770	373
Tongling	1	433,545	221,375	212,170	1,046	644	402	697	471	226
Changle	2	673,717	355,091	318,626	1,474	872	602	828	569	259
Xiamen	1	1,160,135	583,873	576,262	3,851	2,255	1,596	2,145	1,448	697

(To be continued)

**Table 1. Distribution of cancers for the total population, new cases, and deaths in each registry in 2009 (continued)**

Cancer Registry	Category 1: urban; 2: rural	Total population			New cases			Cancer deaths		
		Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
Zhanggong District, Ganzhou	1	420,759	212,159	208,600	904	560	344	567	366	201
Linqu	2	817,857	417,434	400,423	2,043	1,245	798	1,443	958	485
Wenshang	2	762,828	388,454	374,374	1,405	873	532	1,130	724	406
Feicheng	2	733,501	358,739	374,762	2,298	1,387	911	1,488	989	499
Yanshi	2	602,266	306,192	296,074	1,117	583	534	748	429	319
Linzhou	2	1,080,241	557,392	522,849	2,744	1,462	1,282	1,701	1,057	644
Xiping	2	858,002	434,899	423,103	1,628	926	702	1,258	767	491
Wuhan	1	4,832,174	2,484,622	2,347,552	12,590	6,978	5,612	6,961	4,504	2,457
Yunmeng	2	524,801	261,237	263,564	942	558	384	767	503	264
Hengdong	2	713,458	373,923	339,535	1,217	732	485	728	456	272
Guangzhou	1	3,968,216	2,014,580	1,953,636	13,062	7,169	5,893	8,133	5,093	3,040
Sihui	2	413,363	211,351	202,012	947	563	384	601	400	201
Zhongshan	1	1,468,391	732,333	736,058	2,937	1,783	1,154	1,881	1,289	592
Liuzhou	1	1,038,208	533,050	505,158	2,435	1,396	1,039	1,357	862	495
Fusui	2	444,332	236,000	208,332	759	525	234	529	391	138
Jiulongpo District, Chongqing	1	798,618	402,961	395,657	1,458	914	544	1,220	841	379
Qinyang District, Chengdu	1	534,701	277,154	257,547	1,434	845	589	880	583	297
Ziliujing District, Zigong	1	357,600	179,873	177,727	916	597	319	462	330	132
Yanting	2	610,103	316,499	293,604	2,317	1,481	836	1,850	1,177	673
Jingtai	2	233,609	119,953	113,656	395	228	167	244	159	85
Liangzhou District, Wuwei	1	990,583	524,276	466,307	2,837	1,886	951	2,024	1,382	642
Xining	1	882,839	439,175	443,664	1,492	971	521	844	585	259
Xinyuan	2	271,944	138,895	133,049	568	330	238	300	192	108

**Table 2. The incidences of cancers (ICD10:C00–C97) registered in China in 2009**

Areas	Gender	Cancer cases	Crude incidence (1/10 <sup>5</sup> )	ASRIC (1/10 <sup>5</sup> )	ASRIW (1/10 <sup>5</sup> )	Cumulative rate (%)
All areas	Both sexes	244,366	285.91	146.87	191.72	22.08
	Male	137,462	317.97	165.92	220.33	25.68
	Female	106,904	253.09	129.49	166.04	18.64
Urban	Both sexes	174,418	303.39	150.31	195.74	22.23
	Male	95,705	330.19	165.50	219.84	25.25
	Female	78,713	276.15	137.09	175.03	19.44
Rural	Both sexes	69,948	249.98	139.68	182.88	21.76
	Male	41,757	293.10	166.94	220.94	26.65
	Female	28,191	205.25	113.07	146.24	16.83

ASRIC, age-standardized rate for the incidence based on the Chinese standard population; ASRIW, age-standardized rate for the incidence based on the world standard population; cumulative rate refers to the rate for all patients aged 0–74 years.

cancer registration areas, followed by gastric, colorectal, liver, and esophageal cancers. The 10 most common cancers accounted for 76.39% of all new cases, including 84.14% in males and 77.57% in females. Lung cancer was the most frequently diagnosed cancer in

males, followed by gastric, liver, colorectal, and esophageal cancers. Breast cancer was the most frequently diagnosed cancer in females, followed by lung, colorectal, gastric, and liver cancers (Table 4).

**Table 3. Cancer mortalities in cancer registration areas in 2009**

Areas	Gender	Cancer deaths	Crude mortality (1/10 <sup>5</sup> )	ASRMC (1/10 <sup>5</sup> )	ASRMW (1/10 <sup>5</sup> )	Cumulative rate (%)
All areas	Both sexes	154,310	180.54	85.06	115.65	12.94
	Male	969,27	224.20	110.89	151.69	16.94
	Female	573,83	135.85	60.53	82.18	9.06
Urban	Both sexes	104,551	181.86	80.86	110.57	12.12
	Male	647,68	223.45	104.57	143.96	15.71
	Female	39,783	139.57	58.61	80.00	8.69
Rural	Both sexes	49,759	177.83	94.40	126.73	14.78
	Male	32,159	225.73	124.60	168.01	19.62
	Female	17,600	128.14	64.93	87.08	9.89

ASRMC, age-standardized rate for the mortality based on the Chinese standard population; ASRMW, age-standardized rate for the mortality based on the world standard population; cumulative rate refers to the rate for all patients aged 0–74 years.

**Table 4. Incidences of the top 10 cancers in cancer registration areas in 2009**

Rank	Both sexes				Male				Female			
	Site	Incidence (1/10 <sup>5</sup> )	Proportion <sup>a</sup> (%)	ASRIC (1/10 <sup>5</sup> )	Site	Incidence (1/10 <sup>5</sup> )	Proportion <sup>a</sup> (%)	ASRIC (1/10 <sup>5</sup> )	Site	Incidence (1/10 <sup>5</sup> )	Proportion <sup>a</sup> (%)	ASRIC (1/10 <sup>5</sup> )
1	Lung	53.57	18.74	25.34	Lung	70.40	22.14	34.75	Breast	42.55	16.81	23.16
2	Stomach	36.21	12.67	17.85	Stomach	49.61	15.60	25.37	Lung	36.34	14.36	16.41
3	Colorectum	29.44	10.30	14.21	Liver	41.99	13.21	22.49	Colorectum	26.42	10.44	12.29
4	Liver	28.71	10.04	14.78	Colorectum	32.38	10.18	16.23	Stomach	22.50	8.89	10.62
5	Esophagus	22.14	7.74	10.88	Esophagus	30.44	9.57	15.62	Liver	15.11	5.97	7.11
6	Breast	21.21	7.42	11.64	Prostate	9.92	3.12	4.34	Esophagus	13.64	5.39	6.27
7	Pancreas	7.28	2.55	3.35	Bladder	9.78	3.08	4.70	Cervix	12.96	5.12	7.42
8	Lymphoma	6.68	2.34	3.75	Pancreas	8.24	2.59	4.01	Thyroid gland	10.09	3.99	6.50
9	Bladder	6.61	2.31	3.03	Lymphoma	7.71	2.42	4.46	Uterus	8.77	3.46	4.69
10	Thyroid gland	6.56	2.29	4.21	Kidney	7.07	2.22	3.82	Ovary	7.95	3.14	4.54
Top 10		218.40	76.39	109.05		267.55	84.14	135.81		196.32	77.57	99.01

<sup>a</sup>Proportion in all cancer incident cases. Other footnotes as in Table 2.

#### Cancer mortalities of the 10 most common cancers

Lung cancer was the leading cause of death in the cancer registration areas, followed by gastric, liver, esophageal, and colorectal cancers. The 10 most common cancers accounted for 84.27% of all cancer deaths. In males, lung cancer was the leading cause of death, followed by liver, gastric, esophageal, and colorectal cancers; in females, lung cancer was also the leading cause of death, followed by gastric, liver, colorectal, and breast cancers (Table 5).

## Discussion

A recent goal of the National Health Care Reform Program of China is to establish more than 300

registries covering at least one tenth of the population of all rural areas. The year 2009 is the year that the Ministry of Health in China launched the National Program of Cancer Registry. Fifty-two new cancer registries were established based on 43 existing registries supported by central finance through the registry program. According to the NCCR's data submission requirements, 95 registries were expected to submit their 2009 cancer registration data in 2012. As of June 2012, 104 cancer registries had submitted data, a great increase compared with the previous year. In 2012, a total of 222 cancer registries recorded cancer data, covering 200 million people. The number of registries is expected to increase in the coming years. NCCR will focus on improving data quality and expanding the

**Table 5. Mortalities of the 10 most common cancers in cancer registration areas in 2009**

Rank	Both sexes				Male				Female			
	Site	Mortality (1/10 <sup>5</sup> )	Proportion <sup>a</sup> (%)	ASRMC (1/10 <sup>5</sup> )	Site	Mortality (1/10 <sup>5</sup> )	Proportion <sup>a</sup> (%)	ASRMC (1/10 <sup>5</sup> )	Site	Mortality (1/10 <sup>5</sup> )	Proportion <sup>a</sup> (%)	ASRMC (1/10 <sup>5</sup> )
1	Lung	45.57	25.24	20.61	Lung	61.00	27.21	29.15	Lung	29.77	21.91	12.58
2	Liver	26.04	14.42	13.06	Liver	37.96	16.93	19.91	Stomach	16.91	12.45	7.19
3	Stomach	25.88	14.33	11.86	Stomach	34.64	15.45	16.79	Liver	13.84	10.19	6.28
4	Esophagus	16.77	9.29	7.75	Esophagus	23.29	10.39	11.42	Colorectum	12.69	9.34	5.09
5	Colorectum	14.23	7.88	6.15	Colorectum	15.73	7.02	7.28	Breast	10.24	7.54	4.94
6	Pancreas	6.61	3.66	2.98	Pancreas	7.45	3.32	3.59	Esophagus	10.11	7.44	4.22
7	Breast	5.13	2.84	2.52	lymphoma	5.00	2.23	3.43	Pancreas	5.75	4.23	2.41
8	Leukemia	4.28	2.37	2.88	Leukemia	4.59	2.05	2.37	Gallbladder	3.79	2.79	1.50
9	Brain	3.87	2.15	2.29	Prostate	4.19	1.87	1.58	Brain	3.55	2.61	1.99
10	Lymphoma	3.75	2.08	1.86	Brain	4.19	1.87	5.59	Leukemia	3.55	2.61	2.34
Top 10		152.14	84.27	71.96		198.04	88.33	98.11		110.20	81.12	48.55

Footnotes as in Tables 3 and 4.

coverage to improve the cancer surveillance system nationwide by establishing the foundations for cancer control.

To ensure the validity of accepted data, NCCR processes the data carefully according to the national criteria issued in the program protocol. The incidence, mortality, and population data must be reasonable compared with the levels for similar populations, for example, those with a similar location, socioeconomic status, and lifestyle. The indicators of completeness and validity, such as MV%, DCO%, M/I ratio, UB%, and O&U%, were evaluated for every registry's data. Through double evaluations at the provincial and national levels, 72 registries qualified for inclusion, and 32 were considered invalid. The valid data were pooled and analyzed to create the final results for the 2009 annual report.

The cancer incidence and mortality statistics for 2009 were very close to those for 2008<sup>[6]</sup>. Although the included registries were quite different from those that were included in the 2008 report, the overall cancer incidence and mortality data for the two years were reasonably stable, indicating that the pooled data were valid and could represent the cancer burden at the national level. The representativeness of the cancer registry for different groups, such as urban and rural populations and various regions, should be evaluated<sup>[7]</sup>.

The cancer patterns differ considerably between urban and rural areas in China<sup>[8]</sup>. In urban areas, lung cancer, female breast cancer, and colorectal cancer are major cancers with higher incidences than in rural areas. However, cancers of the digestive system, such as

esophageal cancer, gastric cancer, and liver cancer, are common in rural areas. The overall cancer incidence in urban areas is higher and mortality is lower than those in rural areas<sup>[8,9]</sup>. This difference is the result of limited medical resources, a relatively low level of cancer diagnosis and treatment, and a lack of health education in rural areas. In urban areas, the cancer spectrum is tending toward the characteristics of developed countries. The burdens of lung cancer, colorectal cancer, and female breast cancer continue to increase. Cancer in rural areas still retains the cancer patterns of developing countries. Thus, the emphasis of cancer control should consider these differences and implement efficient strategies based on cancer surveillance results.

Currently, the Ministry of Health is developing an action plan for preventing and controlling noncommunicable diseases in the twelfth 5-year plan. Cancer is a major disease seriously threatening people's health in China. The emphasis in rural areas would focus on professional training in primary care centers, health education/promotion, and early diagnosis/treatment, especially for cancers that are common in rural areas, such as esophageal, gastric, cervical, and liver cancers. In cities, behavioral interventions, such as tobacco control and healthy lifestyle promotion, should be enhanced, and high-risk groups should undergo cancer screening to achieve the goal of reducing cancer mortality within a short time.

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