Original Article

National cancer incidence and mortality in China, 2012

Wanqing Chen, Rongshou Zheng, Tingting Zuo, Hongmei Zeng, Siwei Zhang, Jie He

Cancer Hospital, Chinese Academy of Medical Sciences, Peking Union Medical College & National Cancer Center, Beijing 100021, China
Correspondence to: Jie He. Cancer Hospital, Chinese Academy of Medical Sciences, Peking Union Medical College & National Cancer Center, Beijing 100021, China. Email: hejie@cicams.ac.cn.

Background: Population-based cancer registration data in 2012 from all available cancer registries were collected by the National Central Cancer Registry (NCCR). NCCR estimated the numbers of new cancer cases and cancer deaths in China with compiled cancer incidence and mortality rates.

Methods: In 2015, there were 261 cancer registries submitted cancer incidence and deaths occurred in 2012. All the data were checked and evaluated based on the NCCR criteria of data quality. Qualified data from 193 registries were used for cancer statistics analysis as national estimation. The pooled data were stratified by area (urban/rural), gender, age group [0, 1–4, 5–9, 10–14, …, 85+] and cancer type. New cancer cases and deaths were estimated using age-specific rates and corresponding national population in 2012. The Chinese census data in 2000 and Segi's population were applied for age-standardized rates. All the rates were expressed per 100,000 person-year.

Results: Qualified 193 cancer registries (74 urban and 119 rural registries) covered 198,060,406 populations (100,450,109 in urban and 97,610,297 in rural areas). The percentage of cases morphologically verified (MV%) and death certificate-only cases (DCO%) were 69.13% and 2.38%, respectively, and the mortality to incidence rate ratio (M/I) was 0.62. A total of 3,586,200 new cancer cases and 2,186,600 cancer deaths were estimated in China in 2012. The incidence rate was 264.85/100,000 (289.30/100,000 in males, 239.15/100,000 in females), the age-standardized incidence rates by Chinese standard population (ASIRC) and by world standard population (ASIRW) were 191.89/100,000 and 187.83/100,000 with the cumulative incidence rate (0–74 age years old) of 21.82%. The cancer incidence, ASIRC and ASIRW in urban areas were 277.17/100,000, 195.56/100,000 and 190.88/100,000 compared to 251.20/100,000, 187.10/100,000 and 183.91/100,000 in rural areas, respectively. The cancer mortality was 161.49/100,000 (198.99/100,000 in males, 122.06/100,000 in females), the age-standardized mortality rates by Chinese standard population (ASMRC) and by world standard population (ASMRW) were 112.34/100,000 and 111.25/100,000, and the cumulative mortality rate (0–74 years old) was 12.61%. The cancer mortality, ASMRC and ASMRW were 159.00/100,000, 107.231/100,000 and 106.13/100,000 in urban areas, 164.24/100,000, 118.22/100,000 and 117.06/100,000 in rural areas, respectively. Cancers of lung, stomach, liver, colorectum, esophagus, female breast, thyroid cervix, brain tumor and pancreas were the most common cancers, accounting for about 77.4% of all cancer new cases. Lung cancer, liver cancer, stomach cancer, esophageal cancer, colorectal cancer, pancreatic cancer, female breast cancer, brain tumor, leukemia and lymphoma were the leading causes of cancer death, accounting for about 84.5% of all cancer deaths. The cancer spectrum showed difference between urban and rural, males and females both in incidence and mortality rates.

Conclusions: Cancer surveillance information in China is making great progress with the increasing number of cancer registries, population coverage and the improving data quality. Cancer registration plays a fundamental role in cancer control by providing basic information on population-based cancer incidence, mortality, survival and time trend. The disease burden of cancer is serious in China, so that, cancer prevention and control, including health education, health promotion, cancer screening and cancer care services in China, should be enhanced.

Keywords: Cancer registry; incidence; mortality; epidemiology; China

Submitted Dec 14, 2015. Accepted for publication Jan 12, 2016.
doi: 10.3978/j.issn.1000-9604.2016.02.08
View this article at: http://dx.doi.org/10.3978/j.issn.1000-9604.2016.02.08

Introduction

Cancer is one of the major non-communicable diseases in China and around the world. It is now the leading cause of death, causing about one fourth of all deaths in China (1). The National Central Cancer Registry (NCCR) is responsible for collecting population-based cancer registration data from local cancer registries for cancer statistics and publishing cancer registry annual report. The cancer registration data are not only widely used for cancer control and decision making, but also for scientific research (2). In this article, we provide a comprehensive overview of cancer incidence and mortality rates, and estimate new cancer cases and cancer deaths in 2012.

Materials and methods

Data source

The NCCR is a department of National Cancer Center, which is in charge of population-based cancer registry with responsibility of data collection, evaluation and publication from local cancer registries in China. The cancer registration data reported to cancer registries were from local hospitals, community health service centers, the Basic Medical Insurances for Urban Residents and the New-Rural Cooperative Medical System. By 1st June 2015, 261 cancer registries (100 cities and 161 counties) from 31 provinces submitted 2012 data to the NCCR. Data covered about 239,034,428 people, accounting for about 17.65% of the national population at the end of 2012. All cancer cases were classified 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). There were 193 qualified registries finally accepted for the estimation of incidence and mortality in 2012.

National population estimates

The national population in 2012 was estimated based on the 5th National Census data (2000) provided by the National Statistics Bureau of China, taking into account of the changes of age composition, gender ratio and the proportion of urban and rural transformation released by the National Bureau of Statistics (http://data.stats.gov.cn/). The national population in 2012 was stratified by area (urban/rural), gender (male/female) and age groups (0–, 1–4, 5–84 by 5 years, 85+ years). The age-specific death probability was adjusted referring to the Six National Census in 2010. Linear changes were assumed in each age group between the fifth and sixth Population Census.

Quality control

The NCCR checked and evaluated the quality and comparability of submitted data 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/International Association of Cancer Registries (IARC/IACR) (3). The data included in the final analysis should meet the following criteria: the percentage of cases morphologically verified (MV) (%) was not lower than 66%, the percentage of death certificate-only cases (DCO) (%) was lower than 15%, the mortality to incidence ratio (M/I) was between 0.6 and 0.8, and the percentage of the diagnosis of unknown basis (UB) (%) was lower than 5%.

Statistical analysis

Incidence and mortality rates were calculated by area, gender and age groups. The number of new cases and deaths were estimated using the 5-year age-specific cancer incidence/mortality rates and the corresponding populations. The Chinese population in 2000 and World Segi's population were used for age-standardized rates. The cumulative risk of developing or dying from cancer before 75 years of age (in the absence of competing causes of death) was calculated and presented as a percentage. Software including MS-Excel, IARCcrgTools2.05 issued by IARC and IACR were used for data checking and evaluation (4). SAS software (SAS Institute Inc., Cary, USA) was used to calculate the incidence and mortality rates.

Results

Data quality

There were 193 registries accepted by this analysis distributed in 29 provinces, including 74 cities and 119 counties, and covering 198,060,406 of populations, including 100,371,169 males and 97,689,237 females, accounted for 14.63% of national population in end of 2012.

The overall indicators of MV%, DCO%, and M/I ratio were 69.13%, 2.38% and 0.62, respectively. They were 70.63%, 2.63% and 0.59 in urban registries, compared to 67.31%, 2.09% and 0.65 in rural. The quality evaluation for

Table 1 Quality evaluation of cancer registration data, 2012

Cancer	All areas			Urban			Rural		
	MV (%)	DCO (%)	M/I	MV (%)	DCO (%)	M/I	MV (%)	DCO (%)	M/I
Oral & pharyngx	81.03	1.58	0.45	82.92	1.77	0.44	78.28	1.31	0.47
Nasopharynx	76.05	1.38	0.52	77.86	1.79	0.52	74.05	0.93	0.52
Esophagus	78.16	2.01	0.74	73.91	2.97	0.78	80.14	1.57	0.72
Stomach	77.97	2.60	0.71	76.45	3.16	0.71	79.32	2.11	0.72
Colon & rectum	81.31	1.62	0.49	81.78	1.79	0.49	80.48	1.31	0.49
Liver	37.99	4.00	0.88	38.85	4.43	0.88	37.24	3.63	0.88
Gallbladder	48.45	2.83	0.78	47.65	3.26	0.80	49.80	2.09	0.73
Pancreas	39.89	4.11	0.91	39.99	4.77	0.93	39.74	3.06	0.88
Throat	76.69	2.06	0.54	80.42	2.11	0.52	71.49	2.00	0.56
Lung	55.65	3.50	0.81	56.99	4.09	0.83	54.07	2.79	0.80
Other organs in chest	59.68	2.16	0.49	59.94	2.37	0.50	59.18	1.78	0.47
Bone	48.43	4.59	0.79	48.85	6.23	0.77	48.09	3.25	0.80
Skin melanoma	93.55	0.71	0.52	92.47	0.98	0.55	95.28	0.26	0.46
Breast	89.30	0.66	0.24	90.16	0.63	0.21	87.72	0.72	0.28
Cervix	89.01	0.90	0.26	89.16	1.11	0.23	88.83	0.65	0.29
Uterus	85.43	1.15	0.31	88.34	1.16	0.27	81.71	1.14	0.35
Ovary	79.41	1.36	0.42	80.21	1.75	0.44	78.16	0.75	0.39
Prostate	72.62	1.48	0.43	75.55	1.49	0.40	64.15	1.48	0.51
Testis	82.64	0.41	0.19	81.21	0.67	0.14	84.95	0.00	0.27
Kidney	73.86	1.54	0.34	75.97	1.66	0.33	67.97	1.18	0.38
Bladder	76.83	1.51	0.40	78.25	1.65	0.39	74.39	1.29	0.42
Brain, CNS	48.49	3.18	0.62	54.53	3.33	0.59	42.06	3.01	0.65
Thyroid gland	91.63	0.23	0.06	93.29	0.17	0.05	87.02	0.37	0.10
Lymphoma	92.08	0.55	0.60	92.25	0.51	0.59	91.79	0.61	0.60
Leukemia	91.13	1.39	0.71	90.84	1.33	0.71	91.48	1.45	0.71
Other cancers	67.46	2.63	0.52	68.49	2.81	0.54	65.93	2.36	0.49
Total	69.13	2.38	0.62	70.63	2.63	0.59	67.31	2.09	0.65

MV%, proportion of morphological verification; DCO%, percentage of cancer cases identified with death certification only; M/I, mortality to incidence ratio; CNS, central nervous system.

major cancers is presented in *Table 1*.

Incidence and mortality of overall cancers

Incidence

It was estimated that there were 3,586,200 new cases diagnosed as cancer in 2012. The crude incidence rate of all cancers was 264.85/100,000 (289.30/100,000 in males and 239.15/100,000 in females). The age-standardized incidence rates by Chinese standard population (ASIRC) and by world standard population (ASIRW) were 191.89/100,000 and 187.83/100,000, respectively. Among the cancer patients aged 0–74 years, the cumulative incidence rate was 21.82%. The crude incidence rate and age-standardized rate in urban areas were higher than that in rural areas. The crude incidence rates in males and females were higher in urban than in rural. However, after adjusted by age, the cancer incidence rate for males in rural was higher than that in urban areas (*Table 2*).

Age-specific incidence rate

The age-specific incidence rate was relatively lower before

Table 2 Cancer incidence in China, 2012

Areas	Sex	Cases (thousand)	Crude incidence (1/10^5)	ASIRC (1/10^5)*	ASIRW (1/10^5)**	Cumulative rate 0–74 (%)
All areas	Both	3,586.2	264.85	191.89	187.83	21.82
	Male	2,007.6	289.30	216.17	214.33	25.39
	Female	1,578.6	239.15	170.08	163.81	18.32
Urban	Both	1,973.0	277.17	195.56	190.88	21.91
	Male	1,062.0	292.31	212.68	210.63	24.71
	Female	911.0	261.39	181.30	174.00	19.28
Rural	Both	1,613.2	251.20	187.10	183.91	21.67
	Male	945.6	286.00	220.03	218.42	26.14
	Female	667.6	214.28	156.14	151.35	17.14

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

Table 3 Age-specific incidence rates of overall cancers, 2012 (1/10^5)

Age groups	All areas			Urban			Rural		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
Total	264.85	289.30	239.15	277.17	292.31	261.39	251.20	286.00	214.28
0–	12.57	14.04	10.85	15.24	17.62	12.53	10.16	10.88	9.31
1–	11.57	12.22	10.82	13.42	14.19	12.54	9.90	10.46	9.23
5–	7.52	8.25	6.68	7.45	8.19	6.61	7.59	8.30	6.74
10–	8.51	8.73	8.24	8.90	9.19	8.57	8.15	8.33	7.93
15–	10.78	11.09	10.43	11.39	11.64	11.12	10.27	10.64	9.84
20–	17.10	14.13	20.37	17.82	14.31	21.70	16.56	14.00	19.38
25–	29.44	22.48	36.74	33.22	23.64	43.02	25.77	21.39	30.47
30–	51.98	39.22	64.85	57.19	40.81	73.46	43.89	36.81	51.22
35–	87.21	65.99	108.86	93.10	65.53	120.80	79.12	66.61	92.16
40–	154.56	119.56	190.99	158.95	113.97	206.24	148.83	126.92	171.37
45–	257.22	225.13	290.71	263.20	214.31	315.47	249.76	239.02	260.63
50–	342.00	344.36	339.51	358.35	346.12	371.54	319.30	341.85	296.24
55–	524.96	590.89	457.09	518.24	560.56	474.60	533.06	627.57	436.00
60–	721.39	877.75	563.47	698.34	826.18	569.96	746.37	933.29	556.41
65–	937.91	1,188.28	688.42	927.19	1,149.09	710.16	949.13	1,228.51	665.23
70–	1,201.24	1,549.43	866.37	1,213.98	1,544.16	910.21	1,186.79	1,555.11	814.28
75–	1,403.42	1,832.12	1,022.65	1,437.24	1,839.68	1,082.56	1,363.42	1,823.25	951.23
80–	1,512.45	2,052.09	1,084.52	1,621.07	2,146.27	1,180.40	1,386.32	1,934.98	979.04
85+	1,287.68	1,821.92	968.92	1,414.24	1,956.71	1,066.59	1,138.88	1,646.99	860.61

40 years old, then increased dramatically and peaked at age group of 80–84 years (*Table 3*, *Figure 1*). The pattern was similar between urban and rural areas. Comparing the age-specific incidence rate between urban and rural areas, except age from 55–69, urban areas had higher incidence rates than that in rural areas. Between age of 35–74, most age groups of males in rural had higher incidence rate than that in urban. However, in females, the incidences were higher in urban than that in rural areas in every age group except for age group of 5–9 years (*Table 3*, *Figure 1*).

Mortality

It was estimated that there were 2,186,600 patients died from cancer in 2012. The crude mortality of all cancers in China was 161.49/100,000 (198.99/100,000 in males and 122.06/100,000 in females). The age-standardized mortality rates by Chinese standard population (ASMRC) and by world standard population (ASMRW) were 112.34/100,000 and 111.25/100,000, respectively. Among the patients aged 0–74 years, the cumulative mortality rate was 12.61%. The crude cancer mortality rate and age-standardized rate in rural areas were higher than that in urban areas. The crude cancer mortalities and age-standardized rate were higher in rural than in urban areas for males (*Table 4*).

Age-specific mortality

The age-specific mortality rate was relatively lower before 45 years and then dramatically increased, reaching peak after 85 years (*Table 5*, *Figure 2*). The mortality in rural areas was higher at age group of 10–74 years, and urban areas had higher mortalities after 75 years. The mortality in rural areas was highest in the age group of 80–84 years. The age-specific mortality in urban males was lower than that in rural in most of age groups before 80 years old. In females, the mortality in urban was higher than that in rural only for age group over 75 years.

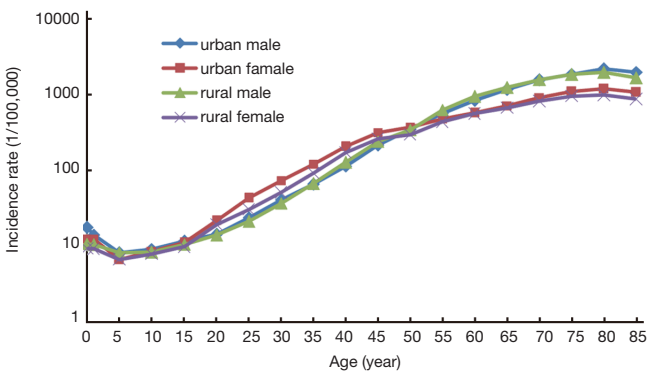

Figure 1 Age-specific cancer incidence rates in urban and rural areas, 2012.

Incidence and mortality for major cancers

Cancer incidence for the 10 most common cancers

Lung cancer was the most common cancer in all areas, followed by stomach cancer, liver cancer, colorectal cancer and esophagus cancer with estimated new cases of 704,800, 423,500, 366,100, 331,300 and 286,700 respectively. Lung cancer was the most frequently diagnosed cancers in males followed by stomach cancer, liver cancer, esophageal cancer and colorectal cancer. Breast cancer was the most common cancer in females followed by lung cancer, colorectal cancer, stomach cancer and cervical cancer (*Table 6*).

Cancer death of the top 10 cancers

Lung cancer was the leading cause of death in China followed by liver cancer, stomach cancer, esophageal cancer and colorectal cancer with estimated deaths of 569,400, 321,200, 298,500, 210,900 and 159,300, respectively. In males, lung cancer was the leading cause followed by liver cancer, stomach cancer, esophageal cancer and colorectal cancer; while in females, lung cancer was still the leading cause followed by stomach cancer, liver cancer, colorectal cancer and esophageal

Table 4 Cancer mortality in China, 2012

Area	Sex	Deaths (thousand)	Mortality (1/10^5)	ASMRC (1/10^5)*	ASMRW (1/10^5)**	Accumulated rate 0–74 (%)
All areas	Both	2,186.6	161.49	112.34	111.25	12.61
	Male	1,380.9	198.99	146.51	145.57	16.57
	Female	805.7	122.06	80.00	78.89	8.66
Urban	Both	1,131.8	159.00	107.23	106.13	11.70
	Male	706.2	194.37	138.60	137.74	15.30
	Female	425.7	122.14	77.74	76.55	8.18
Rural	Both	1,054.8	164.24	118.22	117.06	13.63
	Male	674.7	204.06	155.46	154.28	17.99
	Female	380.1	121.98	82.64	81.60	9.21

*, age-standardized mortality rate (China population, 2000); **, age-standardized mortality rate (Segi'spopulation).

Table 5 Age-specific mortality of overall cancers, 2012 (1/10^5)

Age group	All areas			Urban			Rural		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
All	161.49	198.99	122.06	159.00	194.37	122.14	164.24	204.06	121.98
0–	4.87	4.93	4.80	5.22	4.97	5.51	4.55	4.89	4.14
1–	4.70	4.84	4.53	4.83	4.86	4.80	4.57	4.81	4.28
5–	3.54	3.91	3.11	3.55	3.75	3.33	3.53	4.06	2.91
10–	3.85	4.16	3.48	3.78	4.10	3.41	3.91	4.21	3.54
15–	4.41	5.41	3.26	4.04	5.03	2.90	4.73	5.72	3.56
20–	5.45	5.78	5.08	4.29	4.37	4.20	6.31	6.84	5.73
25–	8.36	9.31	7.37	7.17	7.99	6.34	9.51	10.56	8.39
30–	13.77	15.27	12.26	12.43	13.34	11.52	15.86	18.20	13.43
35–	27.01	30.43	23.53	24.53	26.31	22.74	30.43	35.98	24.63
40–	54.22	62.42	45.67	47.86	52.99	42.46	62.49	74.83	49.80
45–	102.02	123.78	79.32	93.72	110.84	75.42	112.39	140.40	84.05
50–	158.16	201.15	112.82	153.25	194.38	108.90	164.97	210.80	118.11
55–	268.54	350.85	183.83	245.03	321.47	166.21	296.93	386.37	205.06
60–	409.27	546.59	270.58	365.61	488.63	242.06	456.58	609.01	301.66
65–	594.84	798.45	391.94	545.74	733.78	361.83	646.21	864.84	424.04
70–	863.18	1,152.18	585.24	823.18	1,088.66	578.93	908.56	1,220.83	592.75
75–	1,173.85	1,544.84	844.34	1,180.13	1,532.34	869.71	1,166.43	1,559.49	814.09
80–	1,467.65	1,982.06	1,059.74	1,562.53	2,062.72	1,142.85	1,357.48	1,881.74	968.30
85+	1,491.41	2,060.85	1,151.64	1,663.18	2,242.43	1,291.96	1,289.44	1,825.21	996.02

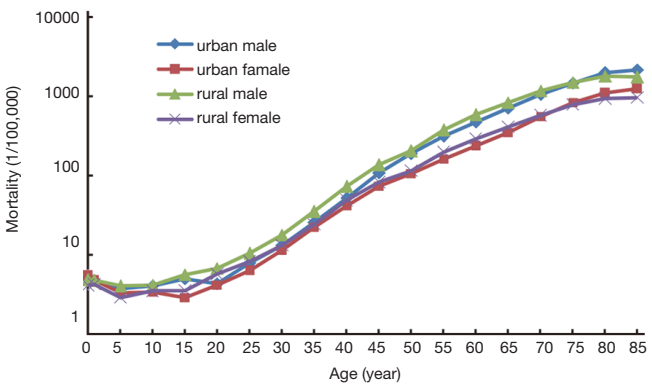

Figure 2 Age-specific cancer mortality in urban and rural areas, 2012.

cancer (*Table* 7).

Cancer incidence of the 10 most common cancers in urban areas

In urban areas, lung cancer was the most frequently diagnosed cancers, followed by colorectal cancer, stomach cancer, female breast cancer and liver cancer with the estimated new cases of 378,200, 210,800, 197,700, 180,600 and 171,900, respectively. The most common sites of cancer were lung, stomach, liver, colon-rectum and esophagus in males, while in females, cancers of breast, lung, colon-rectum, thyroid and stomach were the most common cancers (*Table 8*).

Cancer death of the top 10 cancers in urban areas

Lung cancer was the leading cause of cancer death in urban areas for both males and females with estimated number of deaths of 208,500 and 100,900, respectively. Other cancer types with high mortality in males were liver cancer, stomach cancer, colorectal cancer and esophageal cancer. In females, stomach cancer was the second cause of cancer death, followed by colorectal cancer, liver cancer and breast cancer (*Table 9*).

Cancer incidence of the 10 most common cancers in rural areas

Table 10 shows the 10 most common cancer incidence

Table 6 Top 10 cancer incidence in China, 2012

Rank	Both sexes					Male					Female				
	Site	Cases (thousand)	Incidence ($1/10^5$)	%	ASR* ($1/10^5$)	Site	Cases (thousand)	Incidence ($1/10^5$)	%	ASR* ($1/10^5$)	Site	Cases (thousand)	Incidence ($1/10^5$)	%	ASR* ($1/10^5$)
1	Lung	704.8	52.06	19.65	36.28	Lung	469.9	67.71	23.41	49.62	Breast	272.7	41.32	17.28	30.43
2	Stomach	423.5	31.28	11.81	22.06	Stomach	297.9	42.93	14.84	31.60	Lung	234.9	35.59	14.88	23.56
3	Liver	366.1	27.04	10.21	19.44	Liver	274.0	39.48	13.65	29.48	Colorectum	142.2	21.55	9.01	14.54
4	Colorectum	331.3	24.47	9.24	17.29	Esophagus	203.0	29.25	10.11	21.37	Stomach	125.6	19.03	7.96	12.85
5	Esophagus	286.7	21.17	7.99	14.73	Colorectum	189.1	27.24	9.42	20.18	Cervix	98.5	14.93	6.24	11.39
6	Breast	272.7	41.32	7.60	30.43	Bladder	57.0	8.21	2.84	6.01	Liver	92.1	13.95	5.83	9.37
7	Thyroid	118.6	8.76	3.31	7.36	Prostate	56.5	8.14	2.82	5.90	Thyroid	89.7	13.58	5.68	11.28
8	Cervix	98.5	14.93	2.75	11.39	Pancreas	49.5	7.14	2.47	5.24	Esophagus	83.7	12.68	5.30	8.27
9	Brain, CNS	88.0	6.50	2.46	5.13	Brain, CNS	43.6	6.28	2.17	5.16	Uterus	61.6	9.34	3.90	6.72
10	Pancreas	86.0	6.35	2.40	4.41	Lymphoma	42.5	6.13	2.12	4.81	Ovary	49.4	7.48	3.13	5.69

*, age-standardized incidence rate (China population 2000); CNS, central nervous system.

Table 7 Top 10 cancer mortality in China, 2012

Rank	Both sexes					Male					Female				
	Site	Deaths (thousand)	Mortality ($1/10^5$)	%	ASR* ($1/10^5$)	Site	Deaths (thousand)	Mortality ($1/10^5$)	%	ASR* ($1/10^5$)	Site	Deaths (thousand)	Mortality ($1/10^5$)	%	ASR* ($1/10^5$)
1	Lung	569.4	42.05	26.04	28.81	Lung	386.6	55.71	28.00	40.64	Lung	182.8	27.70	22.69	17.67
2	Liver	321.2	23.72	14.69	16.84	Liver	237.7	34.25	17.21	25.40	Stomach	92.6	14.02	11.49	8.97
3	Stomach	298.5	22.04	13.65	15.16	Stomach	205.9	29.67	14.91	21.72	Liver	83.5	12.65	10.36	8.31
4	Esophagus	210.9	15.58	9.65	10.62	Esophagus	149.1	21.48	10.80	15.63	Colorectum	68.2	10.34	8.47	6.45
5	Colorectum	159.3	11.77	7.29	7.94	Colorectum	91.1	13.13	6.60	9.54	Esophagus	61.9	9.37	7.68	5.82
6	Pancreas	77.5	5.72	3.54	3.92	Pancreas	44.4	6.40	3.22	4.68	Breast	61.6	9.33	7.64	6.43
7	Breast	61.6	9.33	2.82	6.43	Leukemia	30.6	4.41	2.22	3.70	Pancreas	33.1	5.01	4.10	3.19
8	Brain, CNS	53.6	3.96	2.45	3.03	Brain, CNS	29.8	4.30	2.16	3.42	Cervix	24.5	3.72	3.04	2.64
9	Leukemia	52.1	3.85	2.38	3.13	Lymphoma	26.2	3.78	1.90	2.87	Brain, CNS	23.8	3.60	2.95	2.64
10	Lymphoma	43.0	3.18	1.97	2.30	Prostate	23.8	3.42	1.72	2.37	Leukemia	21.5	3.26	2.67	2.58

*, age-standardized mortality rate (China population 2000); CNS, central nervous system.

Table 8 Top 10 cancer incidence in urban areas of China, 2012

Rank	Both sexes					Male					Female				
	Site	Cases (thousand)	Incidence ($1/10^5$)	%	ASR* ($1/10^5$)	Site	Cases (thousand)	Incidence ($1/10^5$)	%	ASR* ($1/10^5$)	Site	Cases (thousand)	Incidence ($1/10^5$)	%	ASR* ($1/10^5$)
1	Lung	378.2	53.13	19.17	36.13	Lung	249.7	68.74	23.52	49.13	Breast	180.6	51.82	19.83	36.48
2	Colorectum	210.8	29.61	10.68	20.34	Stomach	137.7	37.90	12.97	27.25	Lung	128.5	36.86	14.10	23.83
3	Stomach	197.7	27.77	10.02	19.16	Liver	129.9	35.75	12.23	25.65	Colorectum	90.8	26.06	9.97	17.08
4	Breast	180.6	51.82	9.15	36.48	Colorectum	120.0	33.02	11.30	23.75	Thyroid	67.1	19.26	7.37	15.40
5	Liver	171.9	24.15	8.71	16.79	Esophagus	68.2	18.76	6.42	13.36	Stomach	60.0	17.21	6.58	11.41
6	Esophagus	90.5	12.71	4.59	8.67	Prostate	41.3	11.38	3.89	8.11	Cervix	56.3	16.14	6.18	11.78
7	Thyroid	89.5	12.58	4.54	10.12	Bladder	35.7	9.82	3.36	6.98	Liver	42.1	12.07	4.62	7.90
8	Cervix	56.3	16.14	2.85	11.78	Kidney	31.0	8.54	2.92	6.22	Uterus	35.3	10.14	3.88	7.03
9	Pancreas	52.1	7.32	2.64	4.97	Pancreas	30.0	8.25	2.82	5.90	Ovary	30.6	8.78	3.36	6.44
10	Kidney	49.0	6.88	2.48	4.87	Lymphoma	26.8	7.37	2.52	5.63	Brain, CNS	23.7	6.81	2.61	5.03

*, age-standardized incidence rate (China population 2000); CNS, central nervous system.

Table 9 Top 10 cancer mortality in urban areas in China, 2012

Rank	Both sexes					Male					Female				
	Site	Deaths (thousand)	Mortality ($1/10^5$)	%	ASR* ($1/10^5$)	Site	Deaths (thousand)	Mortality ($1/10^5$)	%	ASR* ($1/10^5$)	Site	Deaths (thousand)	Mortality ($1/10^5$)	%	ASR* ($1/10^5$)
1	Lung	309.3	43.46	27.33	28.98	Lung	208.5	57.38	29.52	40.73	Lung	100.9	28.94	23.69	17.97
2	Liver	149.7	21.03	13.23	14.41	Liver	111.9	30.79	15.84	21.94	Stomach	43.2	12.38	10.14	7.74
3	Stomach	136.2	19.13	12.03	12.82	Stomach	93.0	25.61	13.17	18.25	Colorectum	42.6	12.23	10.02	7.38
4	Colorectum	99.7	14.01	8.81	9.12	Colorectum	57.1	15.72	8.09	11.01	Liver	37.8	10.85	8.89	6.91
5	Esophagus	69.1	9.71	6.10	6.48	Esophagus	52.2	14.37	7.39	10.16	Breast	36.2	10.40	8.52	6.84
6	Pancreas	47.8	6.72	4.23	4.49	Pancreas	27.2	7.47	3.85	5.30	Pancreas	20.7	5.94	4.86	3.70
7	Breast	36.2	10.40	3.20	6.84	Leukaemia	16.9	4.65	2.39	3.75	Esophagus	16.9	4.85	3.97	2.94
8	Leukaemia	28.8	4.05	2.55	3.17	Lymphoma	16.4	4.53	2.33	3.34	Gallbladder	12.9	3.71	3.04	2.25
9	Lymphoma	27.2	3.82	2.40	2.70	Prostate	15.9	4.39	2.26	2.93	Ovary	12.9	3.70	3.03	2.49
10	Brain, CNS	26.5	3.72	2.34	2.77	Brain, CNS	14.9	4.09	2.10	3.15	Cervix	12.3	3.54	2.90	2.43

*, age-standardized mortality rate (China population 2000); CNS, central nervous system.

Table 10 Top 10 cancer incidence in rural areas of China, 2012

Rank	Both sexes					Male					Female				
	Site	Cases (thousand)	Incidence ($1/10^5$)	%	ASR* ($1/10^5$)	Site	Cases (thousand)	Incidence ($1/10^5$)	%	ASR* ($1/10^5$)	Site	Cases (thousand)	Incidence ($1/10^5$)	%	ASR* ($1/10^5$)
1	Lung	326.6	50.86	20.25	36.44	Lung	220.2	66.59	23.28	50.20	Lung	106.5	34.17	15.95	23.25
2	Stomach	225.9	35.17	14.00	25.38	Stomach	160.2	48.46	16.95	36.55	Breast	92.1	29.56	13.80	23.07
3	Esophagus	196.2	30.55	12.16	21.67	Liver	144.1	43.58	15.24	34.10	Stomach	65.6	21.06	9.83	14.49
4	Liver	194.1	30.23	12.03	22.62	Esophagus	134.8	40.78	14.26	30.50	Esophagus	61.4	19.70	9.20	13.05
5	Colorectum	120.5	18.76	7.47	13.77	Colorectum	69.1	20.90	7.31	16.06	Colorectum	51.4	16.50	7.70	11.56
6	Breast	92.1	29.56	5.71	23.07	Bladder	21.3	6.43	2.25	4.89	Liver	50.0	16.06	7.50	11.14
7	Cervix	42.3	13.57	2.62	10.79	Brain, CNS	21.1	6.39	2.23	5.38	Cervix	42.3	13.57	6.33	10.79
8	Brain, CNS	41.8	6.51	2.59	5.27	Pancreas	19.6	5.92	2.07	4.48	Uterus	26.3	8.44	3.94	6.37
9	Pancreas	33.8	5.27	2.10	3.75	Leukemia	18.6	5.62	1.97	5.04	Thyroid	22.5	7.23	3.38	6.19
10	Leukemia	32.8	5.11	2.04	4.50	Lymphoma	15.7	4.75	1.66	3.86	Brain, CNS	20.7	6.64	3.10	5.16

*, age-standardized incidence rate (China population 2000); CNS, central nervous system.

rate in rural areas. Lung cancer was the most frequently diagnosed cancers with estimated new cases of 326,600 and incidence rate of 50.86/100,000, followed by stomach cancer, esophageal cancer, liver cancer, and colorectal cancer. The most common sites of cancer in males were lung, stomach, liver, esophagus and colon-rectum, while in females, they were lung cancer, breast cancer, stomach cancer, esophageal cancer and colorectal cancer (*Table 10*).

Cancer death of the top 10 cancers in rural areas

Lung cancer was the leading cause of cancer death in rural areas for both males and females. The number of deaths on lung cancer in rural was 260,100 with mortality of 40.50/100,000. The other cancer types with high mortality were liver cancer, stomach cancer, esophageal cancer and colorectal cancer in males; stomach cancer, liver cancer, esophageal cancer and colorectal cancer in females (*Table 11*).

Discussion

Since 2006, NCCR of China has been publishing cancer statistics annually based on registries' data. The updated cancer statistics published every year are important for observing the changes of cancer rates and useful to make instructions on cancer prevention and control.

In 2015, 261 cancer registries submitted registration data to the NCCR as usual, which were 27 more compared to that in 2011 (5). The population coverage of all registries was about 239 million, accounting for 17.6% of national populations. In order to ensure the reliability of cancer registration data, stringent quality control process is used based on the national criteria issued in program protocol. The incidence, mortality and population from a same registry have to keep reasonable levels compared to past data. If the data are uncompleted, inexplicable or illogical, they would be sent back to the registries for check and modification. The indicators of completeness, comparability and invalidity, such as, MV%, DCO%, MI ratio, UB% and percentage of cancer with undefined or unknown primary site (secondary) (O&U%) were evaluated for each registry's data to judge if submitted data are valid or not. There were 193 registries' data qualified for the update cancer incidence and mortality in 2012. They distributed in 29 provinces, autonomous regions and municipalities, and covered 14.63% of the national population at the end of 2012.

The estimated new cancer cases and deaths were 3.59 million and 2.19 million in 2012, respectively. Compared to the data in 2011, crude incidence and mortality rates were

Table 11 Top 10 cancer mortality in rural areas of China, 2012

Rank	Both sexes				Male				Female			
	Site	Deaths (thousand)	Mortality ($1/10^5$)	%	ASR* ($1/10^5$)	Site	Deaths (thousand)	Mortality ($1/10^5$)	%	ASR* ($1/10^5$)	Site	Deaths (thousand)	Mortality ($1/10^5$)	%	ASR* ($1/10^5$)
1	Lung	260.1	40.50	24.66	28.60	Lung	178.1	53.87	26.40	40.48	Lung	82.0	26.30	21.56	17.33
2	Liver	171.5	26.70	16.26	19.77	Liver	125.8	38.05	18.65	29.58	Stomach	49.4	15.86	13.00	10.38
3	Stomach	162.3	25.27	15.39	17.84	Stomach	112.9	34.14	16.73	25.66	Liver	45.7	14.66	12.02	9.98
4	Esophagus	141.8	22.09	13.45	15.35	Esophagus	96.9	29.30	14.36	21.83	Esophagus	45.0	14.44	11.83	9.13
5	Colorectum	59.6	9.28	5.65	6.57	Colorectum	34.0	10.28	5.04	7.82	Colorectum	25.6	8.21	6.73	5.38
6	Pancreas	29.6	4.61	2.81	3.26	Pancreas	17.3	5.22	2.56	3.95	Breast	25.3	8.12	6.66	5.97
7	Brain, CNS	27.1	4.23	2.57	3.33	Brain, CNS	15.0	4.53	2.22	3.71	Pancreas	12.4	3.97	3.25	2.61
8	Breast	25.3	8.12	2.40	5.97	Leukemia	13.7	4.16	2.04	3.64	Cervix	12.2	3.92	3.21	2.86
9	Leukemia	23.3	3.63	2.21	3.09	Lymphoma	9.8	2.97	1.45	2.33	Brain, CNS	12.2	3.90	3.20	2.95
10	Lymphoma	15.8	2.47	1.50	1.85	Bladder	8.9	2.68	1.32	1.99	Leukemia	9.6	3.07	2.52	2.53

*, age-standardized mortality rate (China population 2000); CNS, central nervous system.

higher in 2012, after adjusted by age, incidence rate was still higher, however, mortality rate was slightly lower than that in 2011 (5). As a basic measure to monitor cancer information, cancer registration in China has been making a great progress in recent years (6). There were 27 more registries submitted cancer data to NCCR and 16 more qualified registries accepted for final analysis compared to 2011.

China had higher incidence rate and lower mortality rate in urban areas than that in rural areas and cancer patterns are quite different. Lung cancer was the most common cancer and the leading cause of cancer death both in urban and rural areas. Cigarette smoking, radon, secondhand smoke exposure would be major factors associated with lung cancer (7). Indoor smoking may be the main reason for lung cancer in rural areas (8). Breast cancer and colorectal cancer are more common in urban, mainly because more urban people lived a western and physical inactively lifestyle. In urban females, cervical cancer and thyroid cancer had ranked fifth and seventh, respectively, which needs to be paid more attention. Cancers from upper digestive system are still the frequent cancers in rural areas, health education and promotion and early detection should be placed priority in cancer strategies. Based on the current situation, different strategies should be implemented in different regions. Attention should not only be paid to the cancer with high incidence and mortality rates, but also to the cancer with rapid increasing trend. According to the population-based survival study in China, survival in rural areas was only half of that in urban areas (9). The main reason may be poor quality of cancer care and limited medical treatment for patients living in rural China. The government should balance the medical resources and take effective measures to bridge the gap.

With the economic development and changes associated with urbanization, as well as the growth and aging population, the incidence and mortality keep increasing in China (10,11). Targeted prevention, early detection, and treatment programs should be carried out by health department to control the increasing cancer burden.

Acknowledgements

We gratefully acknowledged the cooperation of all the population-based cancer registries in providing cancer statistics, data collection, sorting, verification and database creation. The authors assume full responsibility for analyses and interpretation of these data.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

References

1. China Statistical Yearbook, 2010. Beijing: China Statistics Press, 2010.
2. Parkin DM. The evolution of the population-based cancer registry. Nat Rev Cancer 2006;6:603-12.
3. Cancer incidence in five continents. Volume IX. IARC Sci Publ 2008;(160):1-837.
4. Ferlay J. The IARC crgTools Programs. Lyon: IARC, 2006. Available online: http://www.ljemail.org/reference/ReferencesPapers.aspx?ReferenceID=1210715
5. Chen W, Zheng R, Zeng H, et al. Annual report on status of cancer in China, 2011. Chin J Cancer Res 2015;27:2-12.
6. Wei KR, Chen WQ, Zhang SW, et al. Cancer registration in the Peoples Republic of China. Asian Pac J Cancer Prev 2012;13:4209-14.
7. Ridge CA, McErlean AM, Ginsberg MS. Epidemiology of lung cancer. Semin Intervent Radiol 2013;30:93-8.
8. Seow WJ, Hu W, Vermeulen R, et al. Household air pollution and lung cancer in China: a review of studies in Xuanwei. Chin J Cancer 2014;33:471-5.
9. Zeng H, Zheng R, Guo Y, et al. Cancer survival in China, 2003-2005: a population-based study. Int J Cancer 2015;136:1921-30.
10. Chen WQ, Zheng RS, Zeng HM, et al. Trend analysis and projection of cancer incidence in China between 1989 and 2008. Zhonghua Zhong Liu Za Zhi 2012;34:517-24.
11. Zeng HM, Zheng RS, Zhang SW, et al. Trend analysis of cancer mortality in China between 1989 and 2008. Zhonghua Zhong Liu Za Zhi 2012;34:525-31.

Cite this article as: Chen W, Zheng R, Zuo T, Zeng H, Zhang S, He J. National cancer incidence and mortality in China, 2012. Chin J Cancer Res 2016;28(1):1-11. doi: 10.3978/j.issn.1000-9604.2016.02.08

