



Original Article

# Incidence and mortality of liver cancer in Henan province in 2015

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Received 4 March 2019

Available online 15 October 2019

## Abstract

**Objective:** Liver cancer is one of the most common types of cancer. We aimed to use the cancer registration data in 2015 to estimate the incidence and mortality of liver cancer in Henan province.

**Methods:** The data from 37 population-based cancer registries in Henan province were collected for this study. The pooled data were stratified by area, sex, and age group. New cases of liver cancer and deaths due to the disease were estimated using age-specific rates and provincial population in 2015. 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:** After clearance and assessment, data from 30 population-based cancer registries (5 in urban and 25 in rural areas) were included in the analysis. All 30 cancer registries encompassed a total population of 23,421,609 (3,507,984 in urban and 19,913,625 in rural areas), accounting for 21.84% of the provincial population. The proportion of morphological verification (MV%), percentage of cancer cases identified with death certification only (DCO%), and mortality-to-incidence ratio (M/I) were 38.55%, 2.34%, and 0.81, respectively. Approximately 31,639 new cases of liver cancer were diagnosed and 26,057 deaths from liver cancer occurred in Henan in 2015. The crude incidence rate of liver cancer was 27.05/100,000 (36.24/100,000 in men and 17.35/100,000 in women). Age-standardized incidence rates by Chinese standard population and world standard population were 21.10/100,000 and 20.95/100,000, respectively. Liver cancer was more common in men than in women. The incidence rates in urban (26.31/100,000) and rural (27.18/100,000) areas were similar. The crude mortality rate of liver cancer was 21.98/100,000 (29.33/100,000 in males and 14.22/100,000 in females). Age-standardized mortality rates by Chinese standard population and world standard population were 16.93/100,000 and 16.90/100,000, respectively. There was no distinct difference in mortality rates of liver cancer between urban (22.55/100,000) and rural (21.87/100,000) areas.

**Conclusions:** Liver cancer has posed a heavy burden on people in Henan province. Comprehensive measures should be conducted to prevent the increase in the incidence of liver cancer.

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Peer review under responsibility of Chinese Medical Association.



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*Keywords:* Liver cancer; Cancer registry; Incidence; Mortality; Henan province

## Introduction

Liver cancer is the sixth most common cancer and the second leading cause of cancer deaths worldwide.<sup>1</sup> And it is the third most common cancer and the second leading cause of cancer deaths in China.<sup>2</sup> The incidence of liver cancer is extremely diverse in different countries and regions. The highest incidence of liver cancer worldwide can be observed in East Asia, Southeast Asia, Northern Africa, and Southern Africa.<sup>1,3</sup> Liver cancer is a major cancer threatening people's lives and health in China, and the liver cancer burden is very high. Most recently, the Chinese government released the blueprint guide of "Healthy China 2030," in which the official goal was to reduce premature mortality rate of major noncommunicable diseases by 30% from 2015 to 2030.<sup>4</sup> Henan province has a large population and heavy cancer burden.<sup>5</sup> Improving the effectiveness of cancer prevention and control programs and policies plays a crucial role in achieving this health indicator. Epidemiological aspect recognition and incidence and mortality awareness of this cancer may lead to reduction in severity and incidence of liver cancer.

Cancer registration is generally acknowledged as a standardized method for collecting information on cancer incidence worldwide. Cancer registry data with good quality and representativeness can reflect the cancer burden of the country.<sup>6</sup> Presently, cancer registries in Henan encompass more than one-fifth of the population, and the data can basically reflect the provincial incidence and mortality. This study aimed to investigate the incidence and mortality of liver cancer in Henan province.

## Materials and methods

### *Data source*

Liver cancer incidence and mortality data in 2015 were obtained from the Henan Provincial Central Cancer Registry of China (HNCCR). The HNCCR 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, Urban

Resident Basic Medical Insurances, and new rural cooperative medical system. The vital statistics database was linked with the cancer incidence database to identify cases with death certificate only (DCO) and follow up. By June 1, 2018, a total of 37 cancer registries submitted cancer data of 2015. The population coverage was 28,037,125, accounting for 26.30% of the provincial population. All cancer cases were coded according to the International Classification of Diseases for Oncology 3rd edition and the International Statistical Classification of Diseases and Related Health Problems 10th Revision. If it was coded as C22.0-C22.9 through ICD-10, or C22.0 8170/3, C22.0 8174/3, C22.0 8175/3, C22.0 8173/3, C22.0 8171/3, C22.0 8172/3 through ICD-O-3, the data were extracted from the overall cancer database and analyzed further.<sup>6,7</sup>

### *Henan provincial population estimates*

The provincial population in 2015 was estimated based on the Statistical Bulletin on National Economic and Social Development of Henan Province in 2015, considering the changes in age composition, sex ratio, and proportion of urban and rural transformation. The population was stratified by area (urban/rural), sex (male/female), and age groups (0–84 years by 5 years, >85 years).

### *Quality control*

The HNCCR assessed the quality and comparability of data using standard criteria, which were based on the "Guideline for Chinese Cancer Registration" and referred to relevant data quality criterion of the "Cancer Incidence in Five Continents Volume IX" by the International Agency for Research on Cancer (IARC).<sup>6,7</sup> The proportion of morphological verification (MV%), percentage of cancer cases identified with DCO%, mortality-to-incidence ratio (M/I), and percentage of uncertified cancer (UB%) were used to evaluate the completeness, validity, and comparability of data quality.<sup>5,8</sup> Data would be excluded if  $MV\% \leq 55\%$  or  $MV\% \geq 95\%$ ,  $DCO\% \geq 20\%$ ,  $M/I \leq 0.55$  or  $M/I \geq 0.85$ , or  $UB\% \geq 20\%$ . 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 (0–84 years by 5 years, >85 years). A comprehensive overview of cancer incidence, mortality and cumulative risk of developing or dying from cancer before 75 years of age was calculated by the reported cases divided by the corresponding population. Age-standard incidence and mortality rates were adjusted by the Chinese population in 2000 and World Segi's population. We estimated new cases and deaths in Henan with cumulative age-groups cases and deaths, multiplied crude incidence and mortality rates by estimated population in each stratum and added them up,<sup>2</sup> and population stratum were obtained from Statistical Bulletin on National Economic and Social Development of Henan Province, 2015. MS-Excel 2016 (Microsoft, Redmond, WA, USA) and IARCcrgTools (2.05, Ferly, International Agency for Research on Cancer, Lyon, France) were used for data checking and evaluation,<sup>6,7</sup> and SAS 9.4 (SAS Institute Inc., Cary, NC, USA) was used for incidence and mortality rates calculation.

Table 1  
Quality control indexes of liver cancer in Henan in 2015.

Areas	Sex	MV%	DCO%	M/I	UB%
All	Both	38.55	2.34	0.81	0
	Male	38.16	2.50	0.81	0
	Female	39.40	1.97	0.82	0
Urban	Both	33.91	3.03	0.86	0
	Male	30.71	3.55	0.84	0
	Female	41.45	1.82	0.89	0
Rural	Both	39.34	2.22	0.80	0
	Male	39.46	2.32	0.80	0
	Female	39.07	2.00	0.81	0

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

Table 2  
Liver cancer incidence in Henan in 2015.

Areas	Sex	Estimated cases, <i>n</i>	Crude incidence (1/10 <sup>5</sup> )	Percentage (%)	ASIRC (1/10 <sup>5</sup> )	ASIRW (1/10 <sup>5</sup> )	Cumulative rate 0–74 years (%)
All	Both	31,639	27.05	10.48	21.10	20.95	2.43
	Male	21,724	36.24	13.24	29.72	29.54	3.40
	Female	9915	17.35	7.18	12.72	12.61	1.47
Urban	Both	5169	26.31	9.98	19.51	19.64	2.14
	Male	3623	36.25	12.79	28.45	28.84	3.01
	Female	1546	15.98	6.58	11.28	11.32	1.28
Rural	Both	26,470	27.18	10.57	21.44	21.25	2.49
	Male	18,101	36.23	13.32	30.02	29.78	3.47
	Female	8369	17.59	7.28	13.02	12.89	1.50

ASIRC: age-standardized incidence rate by Chinese standard population, 2000; ASIRW: age-standardized incidence rate by world standard population (Segi's population).

## Results

### Data quality

After clearance and assessment, data from 30 population-based cancer registries (5 in urban and 25 in rural areas) were included in the analysis, and data from 7 cancer registries were excluded due to failure to meet the quality criteria. They covered a total population of 23,421,609 (3,507,984 in urban and 19,913,625 in rural areas), including 12,026,186 men and 11,395,423 women and representing 21.84% of the provincial population (107.22 million). The data quality indicators of MV%, DCO%, and M/I ratio were 38.55%, 2.34%, and 0.81, respectively. The quality evaluation is presented in Table 1.

### Incidence

There were approximately 31,639 new cases of liver cancer in Henan province in 2015, accounting for 10.48% of all new cancer cases. The crude incidence rate was 27.05/100,000 (36.24/100,000 in men and 17.35/100,000 in women). The age-standardized incidence rates by Chinese standard population (ASIRC) and world standard population (ASIRW) were 21.10/100,000 and 20.95/100,000, respectively. Among patients aged 0–74 years, the cumulative incidence rate was 2.43%. The incidence rate in men was 2.09 times as high as that in women. The incidence rate in urban areas was similar to that in rural areas (Table 2).

### Age-specific incidence

The incidence rate of liver cancer was relatively low in patients aged <35 years. However, the rate increased dramatically in patients aged ≥60 years and finally peaked in those aged 80–84 years. The patterns of age-specific incidence rate were greatly similar between

urban and rural areas. In either urban or rural areas, the incidence rate in men was higher than that in women (Table 3 and Fig. 1).

### Mortality

Approximately 26,057 patients died from liver cancer in Henan in 2015, accounting for 13.31% of cancer deaths. The crude mortality rate was 21.98/100,000 (29.33/100,000 in men and 14.22/100,000 in women). The age-standardized mortality rates by Chinese standard population (ASMRC) and world standard population (ASMRW) were 16.93/100,000 and 16.90/100,000, respectively. Among patients aged 0–74 years, the cumulative mortality rate was 1.95%. The mortality rate in men was 2.06 times as high as that in women. The mortality rate in urban areas was nearly similar to that in rural areas in both men and women (Table 4).

### Age-specific mortality

The mortality rate of liver cancer was relatively low in patients aged <35 years. The rate dramatically increased in patients aged  $\geq 45$  years, peaking in patients aged  $\geq 85$  years. The patterns were similar between urban and rural areas (Table 5 and Fig. 2). The male age-specific mortality in urban areas was similar to that in rural areas in patients aged <65 years, while it shows a steeper rise than that in rural areas in patients aged  $\geq 70$  years. The pattern of female age-specific mortality in rural areas was similar to that in urban areas.

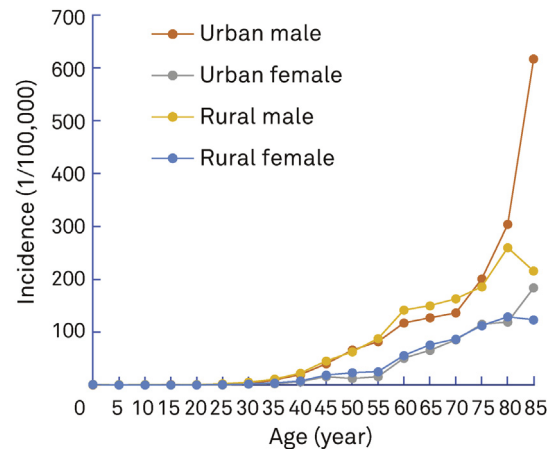


Fig. 1. Liver cancer incidence in Henan in 2015.

### Discussion

In this study, we estimated the number of new cases and deaths of liver cancer in 2015 in Henan province and performed a comprehensive overview of cancer incidence and mortality based on the pooled data from 30 population-based cancer registries. There were approximately 31,639 new cases and 26,057 deaths of liver cancer in Henan in 2015 with the crude incidence rate of 27.05/100,000 and mortality rate of 21.98/100,000. After adjusting for age, the incidence and mortality rates were stable (ASIRC, 21.10/100,000, and ASMRC, 16.93/100,000). Liver cancer is more common in men than in women. The male-to-female

Table 3  
Age-specific incidence rate of liver cancer in Henan in 2015 (1/10<sup>5</sup>).

Age, years	All			Urban			Rural		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
All	27.05	36.24	17.35	26.31	36.25	15.98	27.18	36.23	17.59
0–4	0.66	0.62	0.71	0.56	0	1.19	0.67	0.70	0.64
5–9	0.19	0.36	0	0	0	0	0.22	0.41	0
10–14	0.28	0.51	0	0	0	0	0.32	0.59	0
15–19	0.31	0.36	0.26	0.46	0.89	0	0.29	0.28	0.31
20–24	0.52	0.81	0.21	0.39	0.77	0	0.54	0.81	0.25
25–29	1.31	2.01	0.58	0.31	0.59	0	1.49	2.27	0.68
30–34	3.28	4.67	1.81	1.57	1.56	1.59	3.58	5.20	1.85
35–39	7.34	10.75	3.64	6.26	9.61	2.71	7.56	10.98	3.84
40–44	14.68	21.76	7.16	12.83	19.35	6.07	15.06	22.26	7.39
45–49	31.58	44.56	18.23	28.23	40.12	15.58	32.24	45.46	18.75
50–54	42.55	63.27	21.29	39.44	66.07	12.11	43.18	62.71	23.13
55–59	55.54	86.60	23.67	48.93	81.70	15.91	56.86	87.56	25.23
60–64	96.64	137.90	55.28	84.23	117.41	50.97	98.86	141.57	56.05
65–69	110.21	146.78	74.15	94.29	127.09	65.65	113.09	150.09	75.80
70–74	121.74	158.78	86.54	109.50	136.33	85.20	124.10	162.97	86.80
75–79	147.68	188.04	112.64	155.25	200.48	114.92	146.35	185.81	112.24
80–84	185.32	266.31	127.42	194.44	303.62	119.08	183.71	259.89	128.91
$\geq 85$	175.21	258.09	129.52	339.54	616.84	183.62	155.97	215.48	123.24

Table 4  
Liver cancer mortality in Henan in 2015.

Areas	Sex	Estimated cases, <i>n</i>	Crude mortality (1/10 <sup>5</sup> )	Percentage (%)	ASMRC (1/10 <sup>5</sup> )	ASMRW (1/10 <sup>5</sup> )	Cumulative rate 0–74 years (%)
All	Both	26,057	21.98	13.31	16.93	16.90	1.95
	Male	17,803	29.33	14.89	24.08	24.10	2.77
	Female	8254	14.22	10.81	10.06	10.02	1.13
Urban	Both	4531	22.55	13.48	16.74	16.87	1.80
	Male	3119	30.49	15.03	24.26	24.53	2.50
	Female	1412	14.30	10.98	9.91	10.04	1.13
Rural	Both	21,526	21.87	13.28	17.01	16.97	1.97
	Male	14,684	29.12	14.87	24.11	24.11	2.82
	Female	6842	14.20	10.78	10.11	10.05	1.13

ASMRC: age-standardized mortality rate by Chinese standard population in 2000; ASMRW: age-standardized mortality rate by world standard population (Segi's population).

Table 5  
Age-specific mortality of liver cancer in Henan in 2015 (1/10<sup>5</sup>).

Age, years	All			Urban			Rural		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
All	21.98	29.33	14.22	22.55	30.49	14.30	21.87	29.12	14.20
0–4	0.20	0.12	0.28	0.56	0	1.19	0.15	0.14	0.16
5–9	0.26	0.48	0	0	0	0	0.29	0.55	0
10–14	0.14	0.26	0	0	0	0	0.16	0.29	0
15–19	0.13	0.12	0.13	0	0	0	0.15	0.14	0.15
20–24	0.42	0.40	0.43	0.39	0.77	0	0.42	0.35	0.50
25–29	1.26	1.83	0.67	1.22	2.37	0	1.27	1.73	0.79
30–34	1.52	1.94	1.09	0.39	0	0.80	1.72	2.27	1.14
35–39	5.02	7.82	2.00	4.94	7.69	2.03	5.04	7.85	1.99
40–44	8.71	13.10	4.06	5.97	11.14	0.61	9.29	13.50	4.80
45–49	19.88	31.53	7.91	16.08	26.11	5.42	20.63	32.62	8.39
50–54	31.91	47.52	15.90	31.87	48.77	14.53	31.92	47.27	16.17
55–59	37.98	57.73	17.71	32.62	51.06	14.04	39.05	59.04	18.45
60–64	73.08	105.72	40.36	72.72	104.09	41.26	73.14	106.02	40.19
65–69	98.32	137.51	59.68	80.10	109.19	54.71	101.62	142.27	60.64
70–74	110.74	147.67	75.63	113.97	138.68	91.58	110.12	149.36	72.48
75–79	137.04	173.33	105.54	173.81	232.70	121.30	130.55	162.66	102.80
80–84	191.23	257.20	144.07	214.16	331.22	133.37	187.19	244.47	145.99
≥85	211.48	310.10	157.13	346.07	580.55	214.22	195.73	277.98	150.50

ratio was 2.09 and 2.06 for incidence and mortality rate, respectively. The incidence and mortality rates in urban areas were similar to those in rural areas.

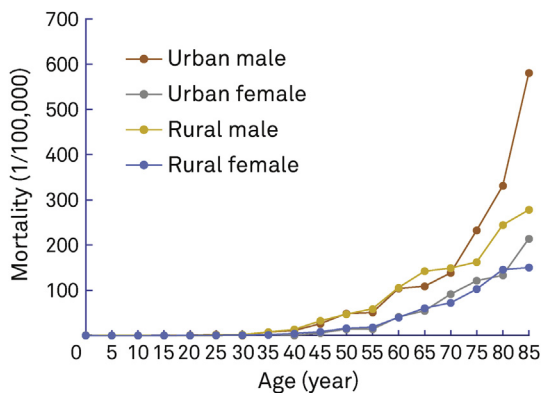


Fig. 2. Liver cancer mortality in Henan in 2015.

The incidence of liver cancer is extremely diverse in different countries and regions. Based on the continental division, the highest and lowest age-standardized incidence rates of liver cancer were 20.9 and 3.1 for Eastern Asia and Northern Europe, respectively.<sup>3</sup> The highest ASIRW was 78.1/100,000 in Mongolia and the lowest was 0.9/100,000 in Nepal, respectively.<sup>3</sup> More than half of global new cases and deaths of liver cancer are from China.<sup>9</sup> We found that the incidence and mortality rates of liver cancer in Henan province were higher than the average rates in China.<sup>2</sup> Liver cancer had the highest prevalence in South China and lowest in North China based on geographic regions.<sup>2</sup> According to the Henan cancer registry annual report 2017,<sup>10</sup> liver cancer had increased prevalence in the east and south of Henan province. In Suixian County, Shenqiu

County, Dancheng County, and Luoshan County, the incidence and mortality rates were higher than those in other areas.

Liver cancer is one of the most common cancers. The incidence and mortality of liver cancer both ranked fourth in Henan province, and fourth and second in China among all cancer types, respectively.<sup>10,11</sup> To our knowledge, age plays a critical role in cancer development. The incidence and mortality rates of liver cancer increase with age like other most common cancer types. Environmental risk factors of liver cancer have been extensively investigated. Risk factors, including exposure to aflatoxin B1, alcohol consumption, cigarette smoking, and unhealthy diet, may have partially contributed to the trends in liver cancer incidence.<sup>12</sup> Moreover, nearly 80% of cases of primary liver cancer can be attributed to chronic viral infections with either hepatitis B virus (HBV, 50%–55%) or hepatitis C virus (HCV, 25%–30%).<sup>13,14</sup>

Several studies reported a decreasing trend in the incidence of liver cancer in China. Zheng et al.<sup>15</sup> reported that between 2000 and 2014, the age-standardized incidence rates of liver cancer decreased by about 2.2% per year in males and 2.5% per year in females. Meanwhile, the age-standardized mortality rates decreased by about 2.6% per year in males and 3.1% per year in females. HBV vaccination and the progress in the treatment of hepatitis B were the most effective approaches to reduce liver cancer incidence during the past decades.<sup>15,16</sup>

In Henan province, liver cancer is more prevalent in Huaihe River Area. Since 2008, National Cancer Early Diagnosis and Treatment Project in Huaihe River Area, has been launched in this area including early cancer detection, ecological improvement and health education. In the past two years, mortality rates of liver cancer in Henan have shown a decreasing trend.<sup>17</sup> We conclude that the reduction of mortality rates in Henan might be due to the comprehensive cancer control strategies.

## Conclusion

The population in Henan province has a heavy liver cancer burden. Comprehensive strategies, including early cancer screening and health education and promotion, should be conducted to prevent and control liver cancer. Our study will serve as a basis for liver cancer control planning, implementation, and public-health policy evaluation, as well as scientific research.

## Conflicts of interest

The authors have no conflicts of interest to declare.

## Acknowledgements

We gratefully acknowledge all population-based cancer registries for their efforts in data collection and verification. The authors take full responsibility in the analysis and interpretation of these cancer registry data. We also thank the support from the Doctoral Research Start-up Fund of Zunyi Medical University (ZMU [2017] 05).

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Edited by Pei-Fang Wei