Original Article

Incidence and mortality of colorectal cancer in China, 2011

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Objective: Colorectal cancer is the third most common type of cancer and the fourth leading cause of cancer-related death in the world. This article provides the most up-to-date overview of colorectal cancer burden in China.

Methods: Totally 234 cancer registries submitted data of 2011 to the National Central Cancer Registry (NCCR). Qualified data from 177 registries was pooled and analyzed. The crude incidence and mortality rates of colorectal cancer were calculated by age, gender and geographic area. The numbers of new cases and deaths were estimated using the 5-year age-specific cancer incidence/mortality rates and the corresponding populations. China census in 2000 and Segi's world population were applied for age standardized rates.

Results: The estimate of new cases diagnosed with colorectal cancer of China in 2011 was 310,244 (178,404 for males and 131,840 for females, 195,117 in urban areas and 115,128 in rural areas), accounting for 9.20% of overall new cancer cases. The crude incidence of colorectal cancer ranked fourth in all cancer sites with rate of 23.03/100,000 (25.83/100,000 for males and 20.08/100,000 for female, 28.25/100,000 in urban areas and 17.54/100,000 in rural areas). The age-standardized rates by China population and by World population were 16.79/100,000 and 16.52/100,000, respectively. The estimated number of colorectal cancer deaths of China in 2011 was 149,722 (86,427 for males and 63,295 for females, 91,682 in urban areas and 58,040 in rural areas), accounting for 7.09% of overall cancer deaths. The crude mortality rate for colorectal cancer ranked fifth leading cause of cancer-related death in all cancer sites with rate of 11.11/100,000 (12.51/100,000 for males and 9.64/100,000 for female, 13.27/100,000 in urban areas and 8.84/100,000 in rural areas). The age-standardized rates by China population and by World population for mortality were 7.77/100,000 and 7.66/100,000, respectively. For both of incidence and mortality, the rates of colorectal cancer were much higher in males than in females, and in rural areas than in urban areas. The rate of colorectal cancer increased greatly with age, especially after 40 or 45 years old.

Conclusions: Colorectal cancer is a relative common cancer in China, especially for males in urban areas. Targeted prevention and early detection programs should be carried out.

Keywords: Colorectal cancer; incidence; mortality; cancer registry; China

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Introduction

In 2012, it was estimated that 1,360,000 people were diagnosed with colorectal cancer and 694,000 people died from this disease worldwide (1). These values make colorectal cancer the third most common type of cancer and the fourth leading cause of cancer-related death. There is wide geographical variation in the incidence of colorectal cancer and almost 55% of the cases occur in more developed regions. In china, colorectal cancer is the sixth

most common cancer and the fifth leading cause of death in 2010 (2). Time trend analysis showed that the incidence of colorectal cancer is increasing since 1998 (3).

The National Central Cancer Registry (NCCR) is responsible for cancer data collection, evaluation and publication in China. In 2014, NCCR collected data for the calendar year of 2011 from 234 registries. Qualified data from 177 registries were accepted as sources of the annual report to reflect cancer incidence and mortality in the registration areas.

In this study, colorectal cancer cases were retrieved from the national database for analysis. An overview of colorectal cancer statistics of 2011 in China was provided, including the estimated numbers of new cases and deaths in males and female, incidence rates and mortality rates by sex, age and geographic area.

Materials and methods

Incidence and mortality data

NCCR is responsible for cancer data collection, evaluation and publication from local population-based cancer registries. The cancer information was reported to the cancer registries from local hospitals, community health centers, including the Basic Medical Insurances for Urban Residents and the New-Rural Cooperative Medical System. The Vital Statistical Database was linked with the cancer incidence database for identifying cases with death certificate only (DCO) and follow-up. By 1st June 2014, 234 cancer registries (98 cities and 136 counties) from 31 provinces submitted 2011 data to the NCCR. Data covered about 221,390,275 people, accounting for about 16.43% of the national population. 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). Invasive cases of colorectal cancer (ICD-10: C18-C21) were extracted and analyzed from the overall cancer database. Incidence and mortality [2011] were based on data from 177 population-based cancer registries which distributed in 28 provinces (77 in urban and 100 in rural areas) and covered a total of 175,310,169 populations (98,341,507 in urban and 76,968,662 in rural areas) including 88,655,668 males and 86,654,501 females, accounting for 13.01% of the national population.

Population data

The population was estimated based on the fifth National Population 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 2011 was stratified by area (urban/rural), gender (male/female) and age groups (0-, 1-4, 5-84 by 5 years, 85+ years). The changes of age-specific death probability were also adjusted when calculating population. Linear changes were assumed in each age group between the fifth and sixth Population Censuses.

Quality control

Based on "Guideline of Chinese Cancer Registration" and the standard of data inclusion in "Cancer Incidence in Five Continents Volume IX", each cancer registration data were evaluated by the quality indicators, including the proportion of morphological verification (MV%), percentage of death certificated only (DCO%) and mortality to incidence ratio (M/I) (4-6).

Statistical analysis

Incidence and mortality rates were calculated by area, gender and age groups. The numbers 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 International Agency for Research on Cancer (IARC) and International Association of Cancer Registries (IACR) was used for data checking and evaluation. Statistical Analysis System (SAS) software (SAS Institute Inc., Cary, USA) was used to calculate the incidence and mortality rates.

Results

Data quality

The MV%, DCO%, M/I ratio, and the proportion of diagnosis of unknown basis (UB%) of colorectal cancer in 2011 were 82.50%, 1.53%, 0.49 and 0.31 in all registries, 83.56%, 1.50%, 0.48 and 0.35 in urban areas, and 80.11%,

Table 1 Quality control index of colorectal cancer in China in 2011

Areas	Sex	M/I	MV%	DOC%	UB%
All	Both sexes	0.49	82.50	1.53	0.31
	Male	0.49	82.95	1.45	0.29
	Female	0.49	81.90	1.65	0.33
Urban areas	Both sexes	0.48	83.56	1.50	0.35
	Male	0.49	83.83	1.46	0.33
	Female	0.48	83.21	1.56	0.38
Rural areas	Both sexes	0.50	80.11	1.60	0.22
	Male	0.50	81.00	1.42	0.21
	Female	0.51	78.87	1.85	0.24

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

1.60%, 0.50 and 0.22 in rural areas, respectively (*Table 1*). Higher data quality was obtained in urban areas compared with rural areas.

Incidence

The estimate of new cases diagnosed with colorectal cancer of China in 2011 was 310,244 (178,404 for males and 131,840 for females, 195,117 in urban areas and 115,128 in rural areas), accounting for 9.20% of overall new cancer cases. The crude incidence rate for colorectal cancer was 23.03/100,000 which made it fourth most common cancers in all cancer sites. The age-standardized rates by China population (CASR) and by World population (WASR) were 16.79/100,000 and 16.52/100,000, respectively. Among the patients aged 0-74 years, the cumulative incidence rate was 1.96%.

Colorectal cancer occurred more often in males than in females. For males, colorectal cancer was the fifth most common cancer, with a crude incidence of 25.83/100,000, whereas the CASR and WASR were 19.70/100,000 and 19.44/100,000, respectively. For females, colorectal cancer was the third most common cancer, with a crude incidence of 20.08/100,000, whereas the CASR and WASR were 14.02/100,000 and 13.73/100,000, respectively. The crude incidence in urban areas was 28.25/100,000, and was higher than that in rural areas (17.54/100,000) ranked second and fifth, respectively. After age standardization, the incidence in urban areas (WASR =19.79/100,000) was still higher than that in rural areas (WASR =12.98/100,000) (*Table 2*).

The incidence was relatively low in age groups under 40 years old and peaked in the 80-84 age group in overall areas and urban areas. In rural areas, the incidence in the 75-79-year-old age group was the highest among all age groups. Notably, after the age of 40 years, the incidence in urban areas was generally higher than that in rural areas for both males and females, especially in older age groups. The incidence rate was constantly higher in males than in females over 30 years old (*Table 3*, *Figure 1*).

Mortality

The estimated number of colorectal cancer deaths of China in 2011 was 149,722 (86,427 for males and 63,295 for females, 91,682 in urban areas and 58,040 in rural areas), accounting for 7.09% of overall cancer deaths. The crude mortality rate for colorectal cancer was 11.11/100,000 and made it fifth leading cause of cancer-related death in all cancer sites. The CASR and WASR for morality were 7.77/100,000 and 7.66/100,000, respectively. Among the patients aged 0-74 years, the cumulative mortality rate was 0.81%.

The mortality was higher in males than in females. The crude mortality, CASR and WASR were 12.51/100,000, 9.40/100,000 and 9.29/100,000 for males, and 9.64/100,000, 6.26/100,000 and 6.16/100,000 for females. These values were 13.27/100,000, 9.01/100,000 and 8.92/100,000 in urban areas, and 8.84/100,000, 6.43/100,000 and 6.30/100,000 in rural areas. Colorectal cancer was ranked the fourth leading cause of cancer death in urban and fifth in rural areas (*Table 4*, *Figure 2*).

The mortality was relatively low in age groups under 45 years and increased with age constantly in overall areas and urban areas. In rural areas, the mortality in the

Table 2 Colorectal cancer incidence in China in 2011

Areas	Sex	Case No.	Crude rate ($1/10^5$)	Ratio (%)	CASR	WASR	Cumulative rate 0-74 (%)	TASR 35-64 ($1/10^5$)	Rank
All	Both sexes	310,244	23.03	9.20	16.79	16.52	1.96	26.01	4
	Male	178,404	25.83	9.30	19.70	19.44	2.29	30.16	5
	Female	131,840	20.08	9.07	14.02	13.73	1.62	21.75	3
Urban areas	Both sexes	195,117	28.25	10.81	20.09	19.79	2.34	29.76	2
	Male	111,594	31.65	11.23	23.53	23.26	2.75	34.39	4
	Female	83,523	24.70	10.29	16.83	16.52	1.95	25.00	3
Rural areas	Both sexes	115,128	17.54	7.35	13.22	12.98	1.55	21.82	5
	Male	66,810	19.76	7.22	15.56	15.33	1.82	25.47	5
	Female	48,318	15.17	7.53	10.95	10.70	1.27	18.09	6

CASR, age-standardized rate (China standard population 2000); WASR, age-standardized rate (World standard population); TASR, truncated age-standardized rate (World standard population).

Table 3 Age-specific incidence rate of colorectal cancer in China in 2011 ($1/10^5$)

Age group (year)	All areas			Urban areas			Rural areas		
	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
All	23.03	25.83	20.08	28.25	31.65	24.70	17.54	19.76	15.17
0-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-	0.02	0.00	0.03	0.00	0.00	0.00	0.03	0.00	0.06
5-	0.01	0.02	0.00	0.00	0.00	0.00	0.02	0.05	0.00
10-	0.01	0.00	0.02	0.02	0.00	0.05	0.00	0.00	0.00
15-	0.22	0.21	0.23	0.36	0.39	0.33	0.11	0.07	0.16
20-	0.80	0.94	0.65	0.88	1.01	0.73	0.75	0.89	0.59
25-	1.35	1.32	1.38	1.42	1.32	1.52	1.27	1.31	1.22
30-	2.76	2.95	2.56	2.82	3.22	2.43	2.66	2.58	2.75
35-	5.36	5.67	5.03	5.54	5.83	5.25	5.12	5.47	4.75
40-	9.74	10.47	8.98	10.39	11.16	9.57	8.96	9.63	8.27
45-	17.99	20.06	15.83	19.45	20.89	17.91	16.22	19.02	13.37
50-	29.56	33.56	25.33	33.78	38.03	29.24	24.01	27.60	20.29
55-	46.50	54.94	37.85	53.93	63.96	43.66	38.29	44.97	31.44
60-	68.52	82.56	54.26	81.39	98.21	64.44	55.40	66.73	43.78
65-	86.45	102.18	70.78	105.90	124.85	87.54	67.17	80.32	53.72
70-	122.57	143.92	101.91	153.09	180.72	127.49	89.68	106.04	73.08
75-	155.24	187.13	127.15	196.12	234.68	162.14	110.22	134.75	88.61
80-	161.50	201.32	130.11	215.20	264.93	173.50	103.70	127.75	85.97
85+	137.24	178.41	113.26	181.24	231.17	150.09	89.44	115.65	75.28

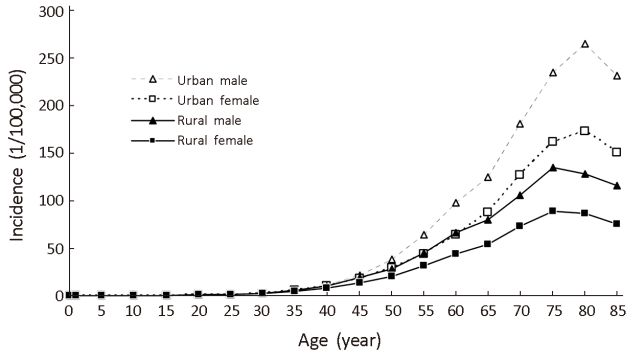

Figure 1 Colorectal cancer incidence in China in 2011.

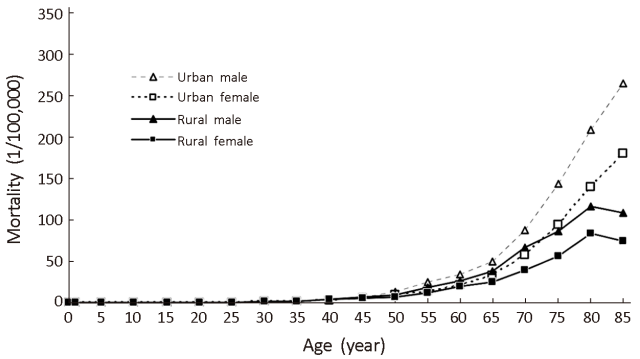

Figure 2 Colorectal cancer mortality in China in 2011.

Table 4 Colorectal cancer mortality in China in 2011

Areas	Sex	Case No.	Crude rate ($1/10^5$)	Ratio (%)	CASR	WASR	Cumulative rate 0-74 (%)	TASR 35-64 ($1/10^5$)	Rank
All	Both sexes	149,722	11.11	7.09	7.77	7.66	0.81	9.10	5
	Male	86,427	12.51	6.42	9.40	9.29	0.99	10.86	5
	Female	63,295	9.64	8.25	6.26	6.16	0.64	7.28	5
Urban areas	Both sexes	91,682	13.27	8.60	9.01	8.92	0.91	9.83	4
	Male	53,010	15.03	7.90	10.96	10.88	1.11	11.96	5
	Female	38,672	11.43	9.78	7.22	7.13	0.72	7.64	3
Rural areas	Both sexes	58,040	8.84	5.55	6.43	6.30	0.71	8.28	5
	Male	33,417	9.88	4.95	7.70	7.54	0.86	9.65	5
	Female	24,623	7.73	6.62	5.23	5.12	0.56	6.87	6

CASR, age-standardized rate (China standard population 2000); WASR, age-standardized rate (World standard population); TASR, truncated age-standardized rate (World standard population).

80-84-year-old age group was the highest among all age groups. The age-specific mortality was higher in urban areas than in rural areas over the age of 45 years and was higher in males than in females over 15 years old (*Table 5*, *Figure 2*).

Discussion

The data provided in this study are the most up-to-date information of colorectal cancer in China from NCCR. Incidence and mortality data of colorectal cancer in China from 177 qualified cancer registries covering 175 million people from 28 provinces are presented. In 2011, the colorectal cancer was the fourth most common cancers and the fifth leading cause of cancer-related death in China. Colorectal cancer was more common for males and in urban areas. And the rates of colorectal cancer increased greatly with age, especially over 40 or 45 years old.

Colorectal cancer is not uniformly common throughout the world. It is mainly a disease of developed countries with a western culture (7). According to GLOBOCAN 2012 (8), the ASR world incidence and mortality of colorectal cancer in 2012 were 17.2/100,000 and 8.3/100,000 in the world, 11.7/100,000 and 6.6/100,000 in less developed countries, and 29.2/100,000 and 11.6/100,000 in more developed countries, respectively. The rates of colorectal cancer in China were at median level in the world and a little higher than those in less developed countries. However, the time trend showed that both the crude and age-standardized incidence rates of colorectal cancer had been increasing in recent 10 years (3).

Both incidence and mortality rates in males are around 28% higher than those in females overall, though this disparity varies by age. The reasons for higher rates in

Table 5 Age-specific mortality rate of colorectal cancer in China in 2011 ($1/10^5$)

Age group	All areas			Urban areas			Rural areas		
	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
All	11.11	12.51	9.64	13.27	15.03	11.43	8.84	9.88	7.73
0-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-	0.03	0.00	0.07	0.00	0.00	0.00	0.06	0.00	0.13
5-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10-	0.02	0.00	0.04	0.04	0.00	0.09	0.00	0.00	0.00
15-	0.09	0.14	0.03	0.20	0.32	0.07	0.00	0.00	0.00
20-	0.22	0.27	0.16	0.21	0.28	0.13	0.23	0.27	0.19
25-	0.47	0.54	0.40	0.44	0.60	0.29	0.50	0.47	0.52
30-	0.95	0.95	0.94	0.95	0.88	1.03	0.94	1.07	0.81
35-	1.56	1.80	1.32	1.47	1.72	1.23	1.68	1.90	1.45
40-	3.29	3.48	3.09	3.04	3.22	2.85	3.58	3.80	3.36
45-	5.92	6.81	4.99	6.24	7.08	5.35	5.53	6.48	4.57
50-	9.64	11.32	7.86	10.65	12.62	8.54	8.31	9.58	6.98
55-	17.14	21.56	12.60	19.05	24.35	13.61	15.03	18.49	11.49
60-	25.14	30.31	19.87	27.69	34.55	20.78	22.53	26.03	18.94
65-	35.66	43.07	28.29	40.54	49.08	32.25	30.84	37.27	24.26
70-	62.74	76.97	48.96	71.75	87.49	57.17	53.02	66.14	39.71
75-	94.79	116.17	75.95	116.85	143.14	93.69	70.49	86.47	56.41
80-	135.86	166.01	112.08	171.56	208.86	140.29	97.43	116.46	83.39
85+	151.96	193.19	127.94	212.23	264.49	179.64	86.47	108.35	74.65

males are not completely understood, but it likely reflects etiologic factors related to complex interactions between sex hormones and risk factor exposures (9,10). The probability of a colorectal cancer diagnosis under 74 years old is 2.29% in males and 1.62% in females.

In China, both incidence and mortality of colorectal cancer are higher in urban areas than in rural areas. Colorectal cancer in urban areas was approximately 52% higher than those in rural areas for age-standardized incidence rate and 41% higher for age standardized mortality rate. Geographic patterns of colorectal cancer incidence and mortality are generally similar for males and females. Much of this disparity is due to the different socioeconomic levels, lifestyles and conditions of local health care in urban and rural areas (11-13).

Conclusions

Generally, colorectal cancer is a relatively common cancer in China. While there has been a dramatic socioeconomic development recently in China, the increasing incidence of colorectal cancer can be expected reasonably. Targeted prevention and early detection programs should be carried out to reverse the trend.

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References

1. Ferlay J, Soerjomataram I, Dikshit R, et al. Cancer incidence and mortality worldwide: Sources, methods and major patterns in GLOBOCAN 2012. Int J Cancer 2015;136:E359-86.
2. Chen W, Zheng R, Zhang S, et al. Annual report on status of cancer in China, 2010. Chin J Cancer Res 2014;26:48-58.
3. Dai Z, Zheng RS, Zou XN, et al. Analysis and prediction of colorectal cancer incidence trend in China. Zhonghua Yu Fang Yi Xue Za Zhi 2012;46:598-603.
4. Curado MP, Edwards B, Shin HR, et al. eds. Cancer

Incidence in Five Continents. Volume IX. Lyon: IARC Scientific Publications 2007;160.
5. Parkin DM, Chen VW, Ferlay J, et al. Comparability and quality control in cancer registration. Lyon: IARC, 1994. Technical Report No. 19.
6. Felay J, Burkhard C, Whelan S, et al. Check and Conversion Programs for Cancer Registries. Lyon: IARC Scientific Publications, 2005. IARC Technical Report No. 42.
7. Haggar FA, Boushey RP. Colorectal cancer epidemiology: incidence, mortality, survival, and risk factors. Clin Colon Rectal Surg 2009;22:191-7.
8. Ferlay J, Soerjomataram I, Ervik M, et al. GLOBOCAN 2012 v1.0, cancer incidence and mortality worldwide: IARC CancerBase No. 11. Lyon: IARC, 2013. Available online: http://globocan.iarc.fr
9. Amos-Landgraf JM, Heijmans J, Wielenga MC, et al. Sex disparity in colonic adenomagenesis involves promotion by male hormones, not protection by female hormones. Proc Natl Acad Sci U S A 2014;111:16514-9.
10. Murphy G, Devesa SS, Cross AJ, et al. Sex disparities in colorectal cancer incidence by anatomic subsite, race and age. Int J Cancer 2011;128:1668-75.
11. Steinbrecher A, Fish K, Clarke CA, et al. Examining the association between socioeconomic status and invasive colorectal cancer incidence and mortality in California. Cancer Epidemiol Biomarkers Prev 2012;21:1814-22.
12. Doubeni CA, Major JM, Laiyemo AO, et al. Contribution of behavioral risk factors and obesity to socioeconomic differences in colorectal cancer incidence. J Natl Cancer Inst 2012;104:1353-62.
13. Béjar LM, Gili M, Infantes B, et al. Incidence of colorectal cancer and influence of dietary habits in fifteen European countries from 1971 to 2002. Gac Sanit 2012;26:69-73.

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