

RESEARCH ARTICLE

Colorectal Cancer Incidence and Mortality in China, 2010

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Abstract

Background: The National Central Cancer Registry of China (NCCR) affiliated to the Bureau of Disease Control, National Health and Family Planning Commission of China is responsible for cancer surveillance in the entire country. Cancer registration data from each local registry located in each province are collected by NCCR annually to be analyzed and published to provide useful information for policy makers and cancer researchers. **Materials and Methods:** Until 1st June, 2013, 219 population-based cancer registries submitted data of 2010 to the National Central Cancer Registry of China covering about 207,229,403 population, and 145 cancer registries were selected after quality evaluation for this study. Colorectal cancer cases were selected from the database according to ICD-10 coded as "C18-C20". We calculated the crude incidence and mortality rates by sex, age groups and location (urban/rural). The China population in 2000 and Segi's population were used as standardized populations for the calculation of age-standardized rates. The 6th National Population Census data of China was used to combined with the cancer registries' data to estimate the colorectal cancer burden in China in 2010. **Results:** Colorectal cancer was the sixth most common cancer in China. It was estimated that there were 274,841 new cases diagnosed in 2010 (157,355 in males and 117,486 in females), with the crude incidence rate of 20.1/100,000, highest in males in urban areas. Age-standardized rates by China standard population of 2000 (ASR_{cn}) and World standard population (Segi's population, ASR_{wld}) for incidence were 16.1/100,000 and 15.9/100,000 respectively. There were 132,110 cases estimated to have died from colorectal cancer in China in 2010 (76,646 men and 55,464 women) with the crude mortality rate of 10.1/100,000. The ASR_{cn} and ASR_{wld} for mortality were 7.55/100,000 and 7.44/100,000 respectively, higher in males and urban areas than in females and rural areas. The incidence and mortality rates increased with age, reaching peaks in the 80-84 year old, and oldest age groups, respectively. **Conclusions:** Colorectal cancer is one of the most common incident cancers and cause of cancer death in China. Primary and secondary prevention, with attention to a health lifestyle, physical activity and screening should be enhanced in the general population.

Keywords: Colorectal cancer - incidence - mortality - China

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Introduction

Colorectal cancer incidence and mortality in China was reported during the past several years. This study was an report for estimated colorectal cancer burden in China in 2010 with using the latest cancer registries data. Colorectal cancer has been one of the most common cancer in the world, especially in developed countries (Ferlay et al). Colorectal cancer was not the first leading cause of cancer death in China, but according to the recent reports, the incidence and mortality of colorectal cancer has been increased over the past 20 years and it would continue increasing if no effective action on colorectal cancer control. Men in urban areas have a relatively higher risk for colorectal cancer, probably because of cigarette smoking, air pollution and working pressure, especially the air pollution is deteriorated with the industrialization and urbanization in China.

The Chinese Cancer Registry Annual report has been

published since 2008, which provided scientific basic data for cancer prevention and control in China. The Chinese Cancer registry annual report system was established by National Center Cancer Registry to promote this work in China. In 2013, 219 cancer registries submitted data of 2010 to the National Central Cancer Registry, and 145 cancer registries have been selected as sources of this study after quality evaluation, and the cancer incidence and mortality for the registration areas covered in 2010 was calculated. The data from this survey can help us understand the incidence, distribution and mortality of colorectal cancer, the patients can really benefit from the future policy.

Materials and Methods

Data source

NCCR of China was responsible for cancer data collection, evaluation, analysis and publication from

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population-based cancer registries located in each province of China. All hospitals, community health centers and other medical institutions with cancer diagnostic capabilities covered by cancer registry should record and report new cancer cases to cancer registries when first diagnosed, and also including centers of township medical insurance and the New Rural Cooperative Medical System. The death record database was regular linked and matched with cancer registration database for identifying vital status and also as a source of supplement for case finding.

Until 1st June, 2013, there were 219 cancer registries (92 cities and 127 counties) from 31 provinces submitted data of 2010 to NCCR, including cancer data and population data, covered about 207,229,403 population totally, accounting for 15.56% of the whole national population. The cancer registries coded cases by the International Classification of Diseases for Oncology, the third edition (ICD-O-3) and ICD-10, and the colorectal cancer (with ICD10 code of C18-20) were selected and analyzed.

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) (Parkin, 1994; Ferlay et al., 2005; Curado, 2007). The detailed standard for data inclusion was shown previously. Generally, the quality index for all cancer sites with DCO% less than 15%, MV% more between 55% to 90%, and M/I between 0.55 to 0.95 were considered acceptable.

Statistical analysis

Crude incidence and mortality rates of colorectal cancer were calculated by sex, area and for 19 age groups (0-, 1-4, 5-9... 80-84, 85+ years). The Chinese standard population of 2000 and the World Segi's population was used for the calculation of age-standardized rates. The cumulative risk of developing or dying from cancer before 75 years (in the absence of competing causes of death after age of 75) was calculated and presented with percentage. Software including MS-FoxPro, MS-Excel, IARCrgTools2.05 issued by IARC and IACR and SAS©9.2 software were used for data check up and statistics.

Results

Pooled data

There were 145 population-based cancer registries selected in this study after evaluation process for each submitted data, covered about 158,403,248 populations, including 80,355,188 males and 78,048,060 females, accounting for 11.88% of the whole national population. 63 registries among them from urban areas covered about 92,433,739 (58.35%) populations, and 82 registries from rural areas with covered about 65,969,509 (41.65%)

population. The MV%, DCO%, and M/I ratio for the pooled data were 80.95%, 1.93% and 0.49 respectively. In urban areas, the MV%, DCO%, and M/I ratio were 81.66%, 1.63% and 0.53 respectively. In rural areas, they were 79.13%, 2.71% and 0.42. There were 274,841 new cases diagnosed with colorectal cancer in 2010 with 157,355 males and 117,486 females. The number of overall colorectal cancer deaths were 132,110, including 76,646 males and 55,464 females. The detailed information for the covering population, incident cases and the cancer deaths of colorectal cancer in each cancer registry was shown in Table 1.

Incidence

In 2010, it was estimated that there were 174,841 of new cases diagnosed as colorectal cancer in China (157,355 men and 117,486 women). Two third of cases occurred in urban areas and one third in rural areas. Much more cases were from eastern areas, followed by middle areas and less cases from western areas (Table 2).

The crude incidence rate for colorectal cancer was 20.90/100,000 in 2010, accounting for 8.89% of overall new cancer cases, ranked the 6th in all cancer sites. The age-standardized rates by China population (ASR_{cn}) and by World population (ASR_{wld}) were 16.14/100,000 and 15.88/100,000, respectively. Among aged before 75, the cumulative incidence rate was 1.90%.

Colorectal cancer occurred more often among men than women. Colorectal cancer was one of the most common cancer for men with the crude incidence rate of 23.38/100,000, whereas the ASR_{cn} and ASR_{wld} were 18.75/100,000 and 18.48/100,000 respectively. For women, colorectal cancer was the third commonest cancer following breast cancer and lung cancer, with the crude incidence rate of 18.30/100,000, where as the ASR_{cn} and ASR_{wld} were 13.63/100,000 and 13.40/100,000. The crude incidence rate in urban areas was 26.70/100,000 and it was higher than that in rural areas (15.01/100,000), ranked fourth and sixth, respectively. After age standardization, incidence rate in

Table 1. Quality Control Index of Colorectal Cancer for 145 Selected Registries in China, 2010

| Areas | Sex | M/I | MV% | DOC% | UB% |
|---------------|------------|------|-------|------|------|
| ALL | Both sexes | 0.49 | 80.95 | 1.93 | 0.50 |
| | Male | 0.49 | 81.39 | 1.92 | 0.49 |
| | Female | 0.48 | 80.38 | 1.96 | 0.52 |
| Urban areas | Both sexes | 0.48 | 81.66 | 1.63 | 0.53 |
| | Male | 0.49 | 82.19 | 1.65 | 0.53 |
| | Female | 0.48 | 80.98 | 1.61 | 0.54 |
| Rural areas | Both sexes | 0.49 | 79.13 | 2.71 | 0.42 |
| | Male | 0.50 | 79.36 | 2.59 | 0.40 |
| | Female | 0.48 | 78.82 | 2.85 | 0.45 |
| Eastern areas | Both sexes | 0.49 | 82.45 | 1.44 | 0.48 |
| | Male | 0.50 | 83.17 | 1.37 | 0.45 |
| | Female | 0.48 | 81.54 | 1.52 | 0.52 |
| Middle areas | Both sexes | 0.46 | 81.15 | 2.27 | 0.34 |
| | Male | 0.47 | 81.06 | 2.28 | 0.33 |
| | Female | 0.45 | 81.26 | 2.26 | 0.36 |
| Western areas | Both sexes | 0.51 | 66.89 | 5.70 | 1.07 |
| | Male | 0.52 | 66.75 | 5.85 | 1.20 |
| | Female | 0.49 | 67.09 | 5.49 | 0.89 |

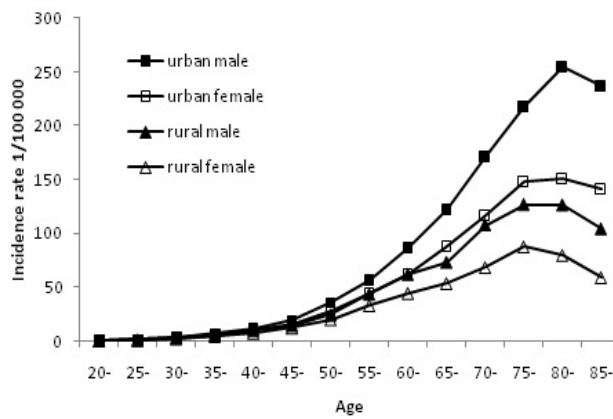


Figure 1. Age-Specific Incidence Rate of Colorectal Cancer in China, 2010

urban (18.65/100,000 for ASR_{wld}) was still higher than that in rural (12.41/100,000 for ASR_{wld}) (Table 2).

The age-specific incidence rate was relatively low before 40 years old. However, the incidence rate was dramatically increasing after 40 years old for male and female, reaching peak near the age group of 80-84 years old both in men and women. Compared the age-specific incidence of colorectal cancer for different locations, the rates in urban areas were generally higher than that in rural areas both for men and women, especially in older age groups (Figure 1).

Mortality

It was estimated that there were 132 110 of patients died in colorectal cancer in China in 2010 (76,646 men and 55,464 women). The number of deaths were much more

Table 2. Colorectal Cancer Incidence by Sex and Area in China, 2010

| Areas | Sex | No.cases | Crude rate (1/10 ⁵) | Ratio (%) | ASR _{cn} (1/10 ⁵) | ASR _{wld} (1/10 ⁵) | Cumulative rate 0-74 (%) | TASR 35-64(1/10 ⁵) | Rank |
|---------------|------------|----------|---------------------------------|-----------|----------------------------------------|-----------------------------------------|--------------------------|--------------------------------|------|
| ALL | Both sexes | 274841 | 20.90 | 8.89 | 16.14 | 15.88 | 1.90 | 24.61 | 6 |
| | Male | 157355 | 23.38 | 8.70 | 18.75 | 18.48 | 2.20 | 27.77 | 5 |
| | Female | 117486 | 18.30 | 9.14 | 13.63 | 13.40 | 1.59 | 21.35 | 3 |
| Urban areas | Both sexes | 176942 | 26.70 | 10.41 | 18.91 | 18.65 | 2.22 | 27.82 | 4 |
| | Male | 101359 | 29.87 | 10.39 | 22.05 | 21.77 | 2.57 | 31.33 | 4 |
| | Female | 75583 | 23.36 | 10.44 | 15.94 | 15.70 | 1.87 | 24.16 | 3 |
| Rural areas | Both sexes | 97899 | 15.01 | 7.03 | 12.67 | 12.41 | 1.49 | 20.92 | 6 |
| | Male | 55996 | 16.78 | 6.73 | 14.65 | 14.38 | 1.73 | 23.62 | 5 |
| | Female | 41903 | 13.16 | 7.47 | 10.77 | 10.52 | 1.25 | 18.15 | 6 |
| Eastern areas | Both sexes | 118263 | 21.50 | 9.20 | 16.37 | 16.06 | 1.92 | 24.11 | 5 |
| | Male | 66391 | 23.59 | 9.10 | 18.84 | 18.51 | 2.21 | 27.40 | 5 |
| | Female | 51872 | 19.32 | 9.34 | 14.01 | 13.71 | 1.63 | 20.71 | 3 |
| Middle areas | Both sexes | 85897 | 20.33 | 8.53 | 15.85 | 15.59 | 1.91 | 25.62 | 6 |
| | Male | 49111 | 22.78 | 8.44 | 18.28 | 18.01 | 2.20 | 28.41 | 5 |
| | Female | 36786 | 17.78 | 8.65 | 13.53 | 13.29 | 1.62 | 22.74 | 4 |
| Western areas | Both sexes | 70681 | 20.64 | 8.83 | 16.08 | 15.91 | 1.84 | 24.13 | 6 |
| | Male | 41853 | 23.79 | 8.43 | 19.19 | 19.01 | 2.18 | 27.51 | 5 |
| | Female | 28828 | 17.31 | 9.48 | 13.08 | 12.95 | 1.49 | 20.60 | 4 |

ASR_{cn}: Age-standardised rate (using China standard population,2000); ASR_{wld}: Age-standardised rate (using World standard population); TASR:Truncated age-standardised rate (using World standard population)

Table 3. Cancer Mortality of Colorectal Cancer in China, 2010

| Areas | Sex | No.cases | Crude rate (1/10 ⁵) | Ratio (%) | ASR _{cn} (1/10 ⁵) | ASR _{wld} (1/10 ⁵) | Cumulative rate 0-74 (%) | TASR 5-64(1/10 ⁵) | Rank |
|---------------|------------|----------|---------------------------------|-----------|----------------------------------------|-----------------------------------------|--------------------------|-------------------------------|------|
| ALL | Both sexes | 132110 | 10.05 | 6.75 | 7.55 | 7.44 | 0.80 | 8.88 | 5 |
| | Male | 76646 | 11.39 | 6.11 | 9.10 | 8.98 | 0.95 | 10.40 | 5 |
| | Female | 55464 | 8.64 | 7.90 | 6.12 | 6.03 | 0.64 | 7.30 | 6 |
| Urban areas | Both sexes | 83312 | 12.57 | 8.05 | 8.58 | 8.45 | 0.90 | 9.36 | 4 |
| | Male | 47953 | 14.13 | 7.34 | 10.33 | 10.21 | 1.07 | 10.77 | 5 |
| | Female | 35359 | 10.93 | 9.26 | 6.98 | 6.86 | 0.72 | 7.89 | 4 |
| Rural areas | Both sexes | 48798 | 7.48 | 5.29 | 6.26 | 6.16 | 0.68 | 8.35 | 5 |
| | Male | 28693 | 8.60 | 4.77 | 7.54 | 7.41 | 0.81 | 10.00 | 5 |
| | Female | 20105 | 6.31 | 6.27 | 5.03 | 4.96 | 0.55 | 6.67 | 6 |
| Eastern areas | Both sexes | 56548 | 10.28 | 6.92 | 7.45 | 7.32 | 0.77 | 7.98 | 5 |
| | Male | 31913 | 11.34 | 6.20 | 8.91 | 8.74 | 0.92 | 9.38 | 5 |
| | Female | 24635 | 9.18 | 8.14 | 6.10 | 6.01 | 0.62 | 6.53 | 5 |
| Middle areas | Both sexes | 38782 | 9.18 | 6.31 | 7.09 | 6.94 | 0.78 | 8.98 | 5 |
| | Male | 22614 | 10.49 | 5.74 | 8.49 | 8.34 | 0.94 | 10.59 | 5 |
| | Female | 16168 | 7.81 | 7.33 | 5.77 | 5.62 | 0.63 | 7.32 | 6 |
| Western areas | Both sexes | 36780 | 10.74 | 7.01 | 8.23 | 8.20 | 0.87 | 10.24 | 5 |
| | Male | 22119 | 12.57 | 6.41 | 10.12 | 10.10 | 1.03 | 11.87 | 5 |
| | Female | 14661 | 8.81 | 8.18 | 6.47 | 6.44 | 0.71 | 8.54 | 4 |

ASR_{cn}: Age-standardised rate (using China standard population,2000); ASR_{wld}: Age-standardised rate (using World standard population); TASR:Truncated age-standardised rate (using World standard population)

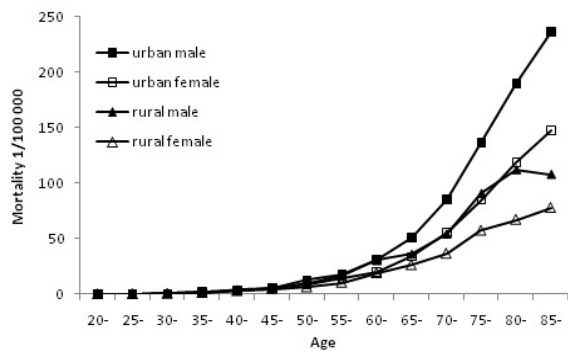


Figure 2. Age-Specific Mortality of Colorectal Cancer in China, 2010

in urban than in rural. Eastern areas had 56,548 colorectal cancer deaths, followed by middle areas (38,782) and western areas (36,780) (Table 3).

The crude mortality rate for colorectal cancer was 10.05/100,000 in 2010, accounting for 6.75% of cancer deaths in 2010. The ASR_{cn} and ASR_{wld} for mortality were 7.55/100,000 and 7.44/100,000, respectively. Among the patients with age of 0-74, the cumulative rate was 0.80%.

The mortality rate of colorectal cancer was higher in males than in females. For males, the crude rate, ASR_{cn} and ASR_{wld} were 11.39/100,000, 9.10/100,000, and 8.98/100,000. For females, the crude rate, ASR_{cn} and ASR_{wld} were 8.64/100,000, 6.12/100,000 and 6.03/100,000. In urban areas, the crude rate, ASR_{cn} and ASR_{wld} were 12.57/100,000, 8.58/100,000 and 8.45/100,000. In rural areas, they were 7.48/100,000, 6.26/100,000 and 6.16/100,000, lower than those in urban areas. Colorectal cancer was the fifth leading cause of cancer death in men and the sixth in women (Table 3).

Age-specific mortality by gender and location were shown in Figure 2. The mortalities were relatively low in age groups before 45 and reached peak near the age group of 85+. The age specific mortalities were higher in urban areas and after that, mortalities in urban areas went beyond these in rural before age of 60 in male and before age of 65 in female.

Discussion

Colorectal cancer (CRC) is one of the most commonly diagnosed cancers in the world (OECD). In USA, CRC-associated mortality rates are high, with approximately 610,000 deaths recorded. Over the last decade, total morbidity and mortality rates of colorectal cancer are increasing steadily in Asia countries, especially in China, colorectal cancer has become a fatal disease. NCCR of China is the biggest and impressive Cancer research center of China, even in the Asia. China has the largest population in the world, also the health care task is a big burden to Chinese policy-makers. The incidence and mortality of malignant tumors is increasing, which greatly affect the overall life-span of Chinese patients. So, as the leading cancer survey and research center of China, it's responsible to collect the epidemic information and cancer incidence of the China mainland, which could help the policy-

makers set efficacious measures to prevent and interfere the epidemiological characteristics of colorectal cancers. This survey got about 219 cancer registries (92 cities and 127 counties) from 31 provinces which submitted data of 2010 to NCCR, including cancer data and population data, covering about 207,229,403 population totally and accounting for 15.56% of the whole national population. All the data of this survey are insured and screened strictly, some low-level research cancer centers are eliminated, in order to make all the data qualifiable and believable.

We can see from the survey that the incidence of colorectal cancer in urban areas is obviously higher than in rural areas (26.70/100,000 in urban and 15.01/100,000 in rural), which can be attributed to the dietary habits, different life-style and air pollution (Dai et al., 2007; Guh et al., 2009; Harriss et al., 2009; Bardou et al., 2013; Johnson et al., 2013). The people in urban areas are more likely to eat meat, high-sugar drinks, no-fiber foods and irregular eating habits (Guh et al., 2009; Harriss et al., 2009). Also, people in urban areas may suffer from more working and living pressure, some results show that when people always live under huge pressure, he or she will develop cancer more easily than others (Citarda et al., 2001; Baxter et al., 2009). Finally, the overall pollution condition of China is under degradation, some poisonous substance may be absorbed into bodies, which can be a potential carcinogenic factor (Hoff et al., 2009; Johnson et al., 2013). Last, Chinese people's living standard has greatly improved, people pay more attention to their health, especially in urban areas, so cancer screening program is widely popularized, so the detection rate of colorectal cancer can be increased especially the use of colonoscope (Winawer et al., 1993; Citarda et al., 2001; Baxter et al., 2009; Hoff et al., 2009; Atkin et al., 2010; Singh et al., 2010; Manser et al., 2012; Zauber et al., 2012). In some countries, including of developing countries, computed tomography colonography is also applied, which is a great help to clinicians.

According to this 2010 colorectal cancer survey, colorectal cancer occurred more often among men than women. Besides genetic predisposition, several risk factors are suggested to play a role in the development and progression of CRC, such as obesity, smoking, and diet (Dai et al., 2007; Guh et al., 2009; Harriss et al., 2009; Johnson et al., 2013). Males are more likely to be addicted to drinking, smoking, and suffer from more living pressure, which may account for the relative high incidence of all kinds of cancer, including colorectal cancer (Morris et al., 1991; Weiderpass et al., 2006; Ibfelt et al., 2013; Levi et al., 2013; Menvielle et al., 2013; Parise et al., 2013; Manser et al., 2014). At present, some scientists say that people's educational background and socioeconomic status also play a role in the unbalanced distribution of colorectal cancer (Morris et al., 1991; Weiderpass et al., 2006; Parise et al., 2013). Social inequalities result from a skewed distribution of material and nonmaterial goods among the members of the society, which is measured by the meritocratic triad of profession, income, and education (Menvielle et al., 2013; Manser et al., 2014). CRC screening programs are available in many countries (Winawer et al., 1993; Zauber et al., 2012),

but indiscriminate inclusion of a population into such a program is expensive and, in the context of exploding health care costs, might not be economically feasible in the long term. Especially in China, as a developing country, lots of people can't afford to get regular physical exams and has no idea of prevention, which can greatly affect the health in some disadvantage groups. Moreover, knowledgeable people care more about healthy diet and living quality. In the future, we should add the SES index into the survey, which could help policy makers develop national policy.

According to this study, the crude incidence rate for colorectal cancer was 20.90/100,000 in 2010, accounting for 8.89% of overall new cancer cases, ranked the 6th in all cancer sites. In China, colorectal cancer is a devastating health threat, factors that protect people from CRC are also well established. Several studies during the past years have demonstrated that endoscopic screening is the most important factor, not only in reducing the incidence of CRC, but also in decreasing CRC-related mortality (Winawer et al., 1993; Citarda et al., 2001; Baxter et al., 2009; Hoff et al., 2009; Atkin et al., 2010; Singh et al., 2010; Manser et al., 2012; Zauber et al., 2012). Lots of companies and official departments have requested all the staffs more than 45 years old to receive colonoscopy and serum tumor markers exams annually, which maybe to some extent help decrease the colon cancer morbidity and mortality. Also, it's necessary to popularize the idea of healthy living habits and proper food intake. With its high cancer incidence, not only colorectal cancer but also other kinds of cancer, the Chinese government takes measures to control pollution, fundamentally maintaining a healthy living environment.

At present, integrated cancer prevention campaigns, efficient screening programs and the access to treatment, whenever effective, continue to be the critical issues of China in the future. Even though China considered is classified as having a high development index (HDI), large inequalities persist between and within different areas that strongly affect the availability of health care. Males, who are over 45 years old and has a unhealthy lifestyle, should receive physical exams annually.

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