

RESEARCH COMMUNICATION

Liver Cancer Mortality Trends during the Last 30 Years in Hebei province: Comparison Results from Provincial Death Surveys Conducted in the 1970's, 1980's, 1990's and 2004-2005

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Abstract

Background and Aims: Liver cancer is a major health problem in low-resource countries. Approximately 55% of all liver cancer occurs in China. Hebei Province is one of the important covering nearly 6% of the population of China. The aim of this paper was to explore liver cancer mortality trends during past 30 years, and provide basic information on prevention strategies. **Methods:** Hebei was covered covered all the three national surveys during 1973-1975, 1990-1992, and 2004-2005 and one provincial survey during 1984-1986. Subjects included all cases dying from liver cancer in Hebei Province. Liver cancer mortality trend and geographic differences across cities and counties were analyzed. **Results:** There were 82,878 deaths in Hebei Province during 2004-2005 with an average mortality rate was 600.9/10,000, and an age-adjusted rate of 552.3/10,000. Those dying of cancer were 18,424 cases, accounting for 22.2% of all deaths, second only to cerebrovascular disease as a cause of death. Cancer mortality was 133.6/100,000 (age-adjusted rate was 119.2/100,000). Liver cancer ranked fourth in this survey with a mortality rate of 21.0/100,000, 28.4/100,000 in males and 13.35/10,000 in females, accounting for 15.7%, 17.1% and 13.4% of the total number of cancer deaths and in males and females, respectively. The sex ratio was 2.13. Since the 1970s, liver cancer deaths of Hebei province have been increasing slightly. The crude mortality rates in the four surveys were 11.3, 16.0, 17.4, 21.0 per 100,000, respectively, with age-adjusted rates fluctuating during the past 30 years, but the trend also being upwards. There is a tendency for the mortality rates to be higher in coastal than mountain areas, and is relative lower in the plain area, with crude mortality rates of 25.3, 22.1, and 19.1 per 100,000, respectively. There were no notable differences in cride data between urban and rural, but the age-adjusted mortality rate in rural was much higher. **Conclusion:** Our study indicated that the mortality of liver cancer in Hebei Province is lower than the national average level. There is a slightly increase trend, especially in some counties. Liver cancer is a major health problem and it is necessary to further promote prevention strategies in Hebei province.

Keywords: Liver cancer - mortality trends - 30 years - Hebei province - China

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Introduction

Liver cancer is the world's fifth most common incident cancer, but the second most frequent cause of cancer death in men. In women, it is the seventh most commonly diagnosed cancer and the sixth leading cause of cancer death (World Health Organization, 2008). An estimated 748,300 new liver cases and 695,900 cancer deaths occurred world wide in 2008 (Jemal, et al., 2011). Hepatocellular carcinoma (HCC) arises from hepatocytes and accounts for about 80% of all primary cancers of the liver. Other tumour types include intrahepatic cholangiocarcinoma (tumours of that part of the bile duct epithelium located within the liver), hepatoblastoma (a malignant embryomal tumour of childhood) and angiosarcoma (arising from blood vessels) are relatively rare compared to HCC.

Liver cancer is a major health problem in low-resource countries, where more than 80% of the worldwide total

occur in Africa and Asia (over 500 000 new annual cases), which is most frequently caused by hepatitis B virus infection. Approximately 55% of all liver cancer occurs in China. According to the recent data from the Third National Causes of Death Sampling Survey (2004-2005), the mortality rate has increased by 28.73% and 144.28%, compared with the second survey in 1990-1992 and the first survey in 1973-1975, respectively. Liver cancer is the most common fatal cancer in rural regions accounts for 20.93% of total cancer death and is the second common death cancer in urban area accounts for 16.61% of total cancer death in China (Chen, 2008).

Hebei Province is located to the north of the Yellow River, and to the east of the Taihang Mountains. Hebei is somewhat overshadowed by its neighbors, Beijing and Tianjin, whose vastness covers an area of 187,693 square kilometers (about 73,363 square miles), and its population is estimated to be at 68,440,000. In this paper, we report the liver mortality trend in Hebei province during the last

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30 years which were covered by all the three national surveys during 1973-1975, 1990-1992, and 2004-2005 respectively and one provincial survey during 1984-1986. The objective of this study is to discuss the possible trends and key preventive strategies of this disease in Hebei province and providing basic information on prevention and control of liver cancer in these areas.

Materials and Methods

Cancer registration

There was no cancer registration report system in Hebei Province before 2009, although Cixian cancer registration set up in 1974 and published their cancer registration data in Cancer Incidence in Five Continents (CI5VIII). After the year 2010, 8 cancer registries have been set up in Hebei Province, covering 4,514,966 people (6.6% of the total population of Hebei Province in 2000).

2.2. National retrospective survey of mortality from 1973 to 1975.
 In the middle 1970s, a nation-wide retrospective survey on causes of mortality from 56 forms of diseases with special emphasis on cancers which was organized by National Office for Cancer Prevention and Control was made in 29 provinces including Hebei Province. This survey covered all the 153 cities and counties in Hebei Province. Firstly, the investigators checked the death cases during 1973-1975 through village group meeting and build up a list, and then collected history of disease, medical consultation, death cause, and evidences of diagnosis of each case. For information that cannot be collected in the meeting, the investigator went to subjects' families, or the hospitals that had clinical treatment for further investigation. For the first time, it provided the national profile and patterns of cancer mortality as well as total death rate in Hebei province as well as in China (Office for Cancer Prevention, 1980).

Provincial sampling retrospective survey of mortality from 1984 to 1986

After 10 years from the first survey, a provincial-wide retrospective survey on causes of mortality with special emphasis on cancers was made in Hebei Province. A stratified sampling method was employed in this survey, covering about 15 cities and counties (5,7400,000 persons) about 10% of the whole population in Hebei province. The method of investigation was same as the first survey (Ma et al., 1990).

National retrospective sampling survey of cancer mortality from 1990 to 1992

This retrospective survey of cancer mortality in some selected areas for the years of 1990-1992 was organized by the National Office for Cancer Prevention and Control, the Ministry of Public Health, China, as one part of the national key program, the Establishment of Surveillance Systems of Cancer Mortality in China (National Office for Cancer Prevention and Control, 2008). A stratified sampling method was employed in this survey, covering about 10% of the whole population in China. A total of 21 cities and counties as sampling areas were enrolled from Hebei Province. In this survey, the list of deceased cases was built up on the basis of the death information from Police Station, Department of Obstetrics in hospitals, and Department of Maternal and Child Health Care. According to the list, the village doctors collected relative information mentioned above and filled out the form of Identification of Death (Hou et al., 1995).

National retrospective sampling survey of cancer mortality from 2004 to 2005

A national retrospective stratified sampling survey of all-death-causes for the period of 2004-2005 was organized by the Ministry of Public Health of China, and the Ministry of Science and Technology of China. It was carried out in 31 provinces/municipalities/autonomous regions including Hebei Province in China in 2006 (Office for Cancer Prevention, Control, 2007). A total of 18 cities and counties including 13,791,868 (20.15%) of total population of Hebei province selected as sampling areas with 2,291,292 urban population and 11,500,576 rural population. The age-structure of sampling population was show in Figure 1. In this survey, the investigators could get the original lists of deceased cases from the registration department firstly, then check them with the relative data from the Police Station, Department of Civil Affairs & Public Health, Department of Family Planning, and finally set up the intact and exact list of the decedent. Based on the deceased cases list, the investigator filled out the questionnaire of death causes followed by checking the medical certificate of death, medical record, or inquiring the family members.

Quality of data

80.1%, 85.9%, 92.1%, 95.2% cancer cases were diagnosed by county hospital or above, in the surveys during 1973-1975, 1984-1986, 1990-1992, and 2004-2005

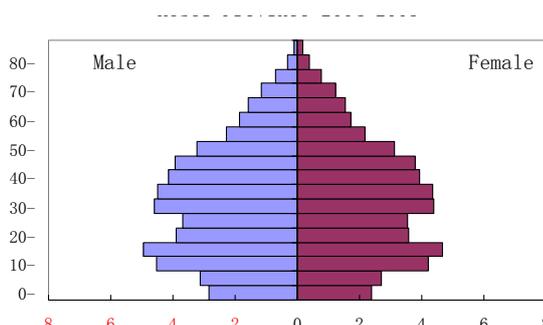


Figure 1. The Age-structure of Sample Populaiton in Hebei Province 2004 to 2005

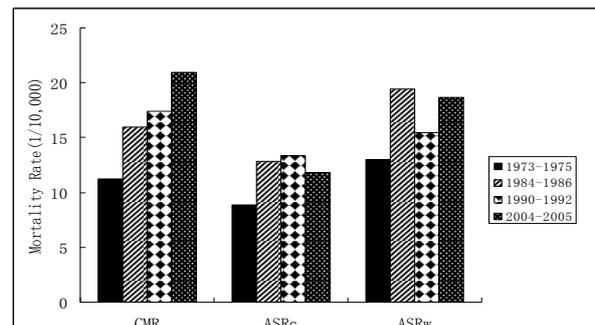


Figure 2. The Liver Cancer Mortality Rate During the Four Surveys

Table 1. Top Ten Cancer Mortality by Sex in Hebei Province, 2004-2005

| Rank | Site | Total | | | Male | | | | Female | | | |
|------|--------------|-------|-------|-------|--------------|-------|-------|-------|--------------|-------|-------|-------|
| | | Cases | CMR | PMR | Site | Cases | CMR | PMR | Site | Cases | CMR | PMR |
| 1 | Lung | 4,143 | 30.04 | 22.49 | Stomach | 2,879 | 40.61 | 24.51 | Lung | 1,397 | 20.84 | 20.93 |
| 2 | Stomach | 4,089 | 29.65 | 22.19 | Lung | 2,735 | 38.58 | 23.28 | Stomach | 1,209 | 18.04 | 18.11 |
| 3 | Esophageal | 3,016 | 21.87 | 16.37 | Esophageal | 2,048 | 28.89 | 17.43 | Esophageal | 967 | 14.43 | 14.48 |
| 4 | Liver | 2,909 | 21.09 | 15.79 | Liver | 2,011 | 28.37 | 17.12 | Liver | 895 | 13.35 | 13.41 |
| 5 | Colorectal | 705 | 5.11 | 3.83 | Colorectal | 411 | 5.80 | 3.50 | Breast | 390 | 5.82 | 5.84 |
| 6 | Brain and NS | 581 | 4.21 | 3.15 | Brain and NS | 327 | 4.61 | 2.78 | colorectal | 293 | 4.37 | 4.39 |
| 7 | Leukemia | 466 | 3.38 | 2.53 | leukemia | 257 | 3.63 | 2.19 | Brain and NS | 254 | 3.79 | 3.80 |
| 8 | Breast | 391 | 2.84 | 2.12 | Pancreatic | 165 | 2.33 | 1.40 | Leukemia | 208 | 3.10 | 3.12 |
| 9 | Pancreatic | 292 | 2.12 | 1.58 | Bladder | 138 | 1.95 | 1.17 | Cervical | 171 | 2.55 | 2.56 |
| 10 | Bone | 229 | 1.66 | 1.24 | Bone | 128 | 1.81 | 1.09 | Pancreatic | 127 | 1.89 | 1.90 |

Table 2. The Mortality Trend of Liver Cancer in Hebei Province During the Four Surveys

| | 1973-1975 | | | 1984-1986 | | | 1990-1992 | | | 2004-2005 | | |
|------|-----------|-------|--------|-----------|-------|--------|-----------|-------|--------|-----------|-------|--------|
| | Total | Male | Female |
| CMR | 11.26 | 15.35 | 6.98 | 15.97 | 22.44 | 9.25 | 17.42 | 24.18 | 10.30 | 21.09 | 28.37 | 13.35 |
| ASRC | 8.88 | 12.47 | 5.17 | 12.8 | 19.23 | 6.12 | 13.34 | 19.14 | 7.49 | 11.84 | 16.57 | 6.99 |
| ASRW | 12.98 | 18.03 | 7.84 | 19.45 | 26.15 | 13.08 | 15.44 | 22.14 | 11.78 | 18.7 | 25.81 | 11.52 |
| PMR | 14.89 | 15.26 | 10.98 | 15.08 | 16.18 | 11.32 | 15.12 | 16.89 | 12.09 | 15.62 | 17.12 | 13.26 |
| Rank | 3 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

respectively. Less than 2.9% cancer cases did not have clinical diagnosis materials, and over 93.1% death causes were confirmed by clinical diagnoses or other higher-level technologies in all four surveys.

Statistical indicators

Liver cancer crude mortality rate (CMR), age-adjusted rate by China's population (ASRC) of 1964, age-adjusted rate by the world population (ASRW) of 1985 and proportional mortality ratio (PMR) were counted respectively for four surveys.

Results

Overall mortality in Hebei Province during 2004-2005

There were 82,878 deaths in Hebei Province during 2004-2005 with the average mortality rate was 600.9/10,000, the age-adjusted mortality rate was 552.3/10,000. Which died of cancer were 18,424 cases, accounting for 22.23% of all causes of death. It ranked the second causes of death only followed the cerebrovascular disease. Cancer mortality was 133.59/10,000 (age-adjusted rate was 119.24/10,000). Males died of cancer was 11,748 cases with the mortality rate was 165.71/10,000 (age-adjusted rate was 153.66/10,000), 6676 cases of female deaths, the mortality rate was 99.60/10,000 (age-adjusted rate of 85.62/10,000). The mortality ratio of males and females was 1.66:1 which males' was significantly higher than that of females. The top ten were lung cancer, stomach cancer, esophageal cancer, liver cancer, colorectal cancer, brain and nervous system tumors, leukemia, breast cancer, pancreatic cancer, bone tumors (Table 1).

The mortality trend of liver cancer

The liver cancer mortality rate was 20.96/100,000 with male 28.37/100,000 and female 13.35/10,000 in Hebei Province during 2004-2005. It is all rank fourth of all kinds of cancers both in males and in females accounting

for 15.65%, 17.12% and 13.26% of total number of all cancer deaths in both sexes, male and female respectively. The age-adjusted rate by China's population (ASRC) was 11.84/100,000, and the age-adjusted rate by the world population (ASRW) was 18.70/100,000. The CMR, ASRC, and ASRW were 28.37, 16.57, and 28.81 per 100,000, for male, and 13.35, 6.99, and 11.52 for female, respectively. The mortality rate of liver cancer for male is much higher than female, the sex ratio was 2.13.

Since the 1970s, liver cancer deaths of Hebei province were increasing slightly. The crude mortality rate of fourth surveys was 11.26, 15.97, 17.42, and 20.96 per 100,000 respectively. For the 1970s, the liver cancer mortality was 11.26 (male 15.35, female 6.98), accounting for 14.89% of cancer death, ranked in third place. For 1980s, it was 15.97 (male 22.44, female 9.25), accounting for 15.08% and ranked three of all cancer death. The liver cancer mortality rate was 17.42 (male 24.18, female 10.30), with 15.12% and fourth ranked of total cancer death in 1990s, it increased by 54.71% compared with 1970s. For 2004 to 2005, the liver cancer mortality rate was 20.96 (male 28.37, female 13.35) with 15.62% of total cancer death and also ranked fourth. The mortality rate increased by 86.14% compared with 1970s. The age-adjusted mortality rate was fluctuation during the past 30 years, but the trend was also upwards (Table 2, Figure 2).

Geographic differences across the country (Tables 3 and 4)

The retrospective data from 2004 to 2005 shows the

Table 3. Liver Cancer Mortality Rate in Urban and Rural Area, 2004-2005 (1/100,000)

| | Urban area | | | Rural area | | |
|--------|------------|-------|-------|------------|-------|-------|
| | CMR | ASRC | ASRW | CMR | ASRC | ASRW |
| Male | 28.82 | 14.26 | 22.56 | 28.24 | 17.1 | 26.07 |
| Female | 11.39 | 5.42 | 8.79 | 13.75 | 7.37 | 12.14 |
| Total | 20.34 | 9.89 | 15.63 | 21.22 | 12.30 | 19.20 |

Table 4. The Liver Adjusted Mortality Rate in Different Cities and Counties from Four Surveys (1/100,000)

| | 1970s | | 1980s | | 1990s | | 2004-2005 | |
|-------------------|-------|--------|-------|--------|-------|--------|-----------|--------|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| Zanhuang County | 14.39 | 6.21 | 19.09 | 6.13 | 17.54 | 9.10 | 18.71 | 4.31 |
| Qianxi County | — | — | — | — | — | — | 22.19 | 7.73 |
| Shexian County | 14.66 | 7.09 | 21.65 | 11.74 | 20.13 | 8.62 | 14.09 | 10.40 |
| Cixian County | 11.62 | 6.58 | 19.25 | 8.34 | 26.45 | 10.90 | 25.72 | 11.53 |
| Wuan County | — | — | — | — | — | — | 16.09 | 8.50 |
| Xuanhua County | — | — | — | — | — | — | 11.89 | 5.73 |
| Chicheng County | 9.22 | 4.31 | 10.29 | 3.92 | 8.97 | 6.06 | 18.29 | 9.05 |
| Fengning County | — | — | — | — | — | — | 22.81 | 9.56 |
| Renxian County | 13.52 | 5.13 | — | — | 28.71 | 9.14 | 20.42 | 7.66 |
| Wangdu County | — | — | — | — | — | — | 18.74 | 5.73 |
| Anxin County | 10.74 | 4.54 | — | — | 21.21 | 9.69 | 9.28 | 4.62 |
| Bazhou County | 11.48 | 4.67 | 13.09 | 3.30 | 27.13 | 9.23 | 19.10 | 7.07 |
| Shenzhou County | 14.18 | 4.10 | — | — | 20.19 | 7.65 | 13.66 | 6.36 |
| Huanghua County | — | — | 22.42 | 10.82 | — | — | 20.72 | 8.15 |
| Tangshan City | — | — | 12.03 | 3.34 | — | — | 11.09 | 4.42 |
| Shijiazhuang City | 17.36 | 7.16 | 21.07 | 5.92 | 20.79 | 8.03 | 21.00 | 6.43 |
| Qinhuangdao City | 12.64 | 5.45 | — | — | 11.98 | 4.83 | 11.61 | 5.60 |
| Zhangjiakou City | — | — | — | — | — | — | 15.99 | 4.83 |

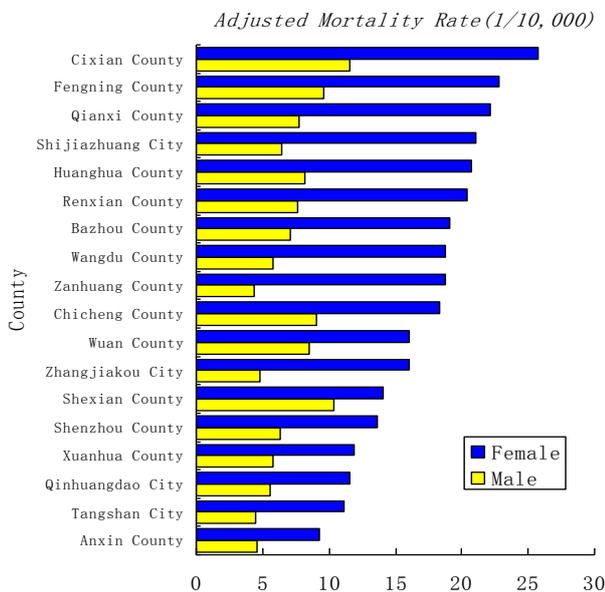


Figure 3. The Liver Cancer Adjusted Mortality Rate in Different Cities and Counties of Hebei Province, 2004-2005

general distribution of liver cancer mortality in Hebei province. There is a tendency for the mortality rate to be higher in the coastal area than in the mountain area, and is relative lower in the plain area, with CMR of 25.28, 22.10, and 19.12 per 100,000, respectively. In terms of crude mortality rates between the areas of the urban and the rural, there were no notable differences. However the adjusted mortality rate of rural is much higher than that of rural (Table 3).

For male, the survey from 2004 to 2005 showed that Cixian county, Fengning county and Qianxi county were the highest adjusted mortality rates in all the 18 cities and counties, 22.19, 22.81 and 22.19 per 100,000, of the liver cancer, which were 1.55-fold, 1.38 -fold and 1.34-fold higher than the average level in Hebei province. Anxin County, Tanshan City and Qinhuangdao City were the lowest in the sampling areas, with 9.28, 11.09 and 11.61

per 100,000, of the liver cancer. For female, the highest was Cixian County, Shexian County and Fengning County with the adjusted mortality rate 11.53, 10.40 and 9.56 per 100,000. The lowest was Anxin County, Tangshan County and Zanhuang County with the adjusted mortality rate 4.31, 4.42 and 4.62 per 100,000 (Table 4, Figure3).

There were six cities and counties enrolled in all the four surveys, that is Cixian County, Shexian County, Zanhuang County, Chicheng County, Bazhou County and Shijiazhuang City. It showed that liver cancer mortality of Cixian County, Chicheng County and Bazhou County increased rapidly. Zanhuang County, Shexian County and Shijiazhuang City remained stable (Table 4).

Discussion

Liver cancer is a common malignancy in China. The first national survey showed the mortality rates of liver cancer in China were 12.5 per 100,000, and 17.6 and 7.3 per 100,000 for males and females. The ASRc and ASRw were 14.52 and 19.96 per 100,000 for male, and 5.61 and 8.07 per 100,000 for female, respectively. In the second national survey from 1990–1992, liver cancer was observed to be the second most common cancer with a mortality rate of 20.4 per 100,000. The rate for men was 29.0 per 100,000, and women, 11.2 per 100,000. The ASRc and ASRw were 17.8 and 23.0 per 100,000, in which, 26.1 and 33.7 per 100,000 in men, and 9.4 and 12.3 per 100,000 in women, respectively. From the third national survey, the liver cancer mortality was found to be 26.26 per 100,000 and 37.55 and 14.45 for males and for females. The ASRc and ASRw were 17.86, 23.48 per 100,000 for both sexes, in which 26.44 and 34.61 for males and 9.20 and 12.34 per 100,000 for females. It also ranked second of all kinds of cancers. The liver cancer mortality of Hebei province was relative lower compared with the national average level from this three national surveys. There were no high risk areas in Hebei province. The highest area during 2004 to 2005 was Cixian County, which liver cancer mortality rate

was 25.72 in male and 11.53 in female. From the result of four surveys, liver cancer in Hebei province showed a slightly increase trend although the adjusted mortality rate fluctuated.

Liver cancer is a fatal disease with very low survival rate because most patients, especially for those in less developed areas, are diagnosed at an advanced stage where the disease is not amenable to potential curative therapy. The five year relative survival rate in Cixian County from 2000 to 2002 was only 4.17% (He et al., 2011). So liver cancer is still a serious health problem in Hebei province and prevention is the key strategies. So far, the major etiological risk factors for primary liver cancer have been identified as infection with HBV, hepatitis C virus (HCV), alcoholic cirrhosis, dietary aflatoxins, and tobacco smoking. In China, chronic HBV infection and exposure to dietary aflatoxins have been considered as the major and common factors attributed to the etiology for liver cancer (Jian et al., 2011). Hence, it is necessary to further promote the primary prevention strategies of liver cancer by diminishing HBV infection and avoid dietary exposures to aflatoxins in Hebei province.

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