

## RESEARCH COMMUNICATION

# Mortality Report of Malignant Tumors in SheXian, Hebei Province, China, from the 1970's to the Present

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### Abstract

**Background:** Investigations into mortality from malignant tumors were initiated in the 1970's in Hebei Province, China, and especially for esophageal cancer the rates were high, Shexian county ranking in first place of the towns that were surveyed.

**Methods:** Since the 1970's, a register system for all causes of death has been in place. Data for the decades of the 1970's, 1980's, 1990's and 2000's century were here checked and analyzed by SPSS software.

**Result:** From the decades of the 1970's onward, the mortality rates of malignant tumors/100,000 were 272.0, 260.1, 211.7 and 180.1, respectively, with significant differences over time ( $\chi^2=240.5$ ,  $P<0.001$ ). The main malignant tumors were esophageal, gastric, liver, lung and cervix cancers. The sum of their percentages of all cancer deaths were 92.1% in the 1970's, 91.6% in the 1980's, 92.1% in the 1990's and 93.9% in the 21st century. The sex ratios (male vs female) were 1.5, 1.5, 1.7 and 2.0 respectively, with an ascending trend. Mortality rates of malignant tumors increased with age, with an obvious geographic distribution. The highest mortality of malignant tumors was evident in the area where the Qingzhang and Zhuozhang rivers join.

**Conclusion:** From 1970's to the beginning of the 21st century, the mortality rate of malignant tumors has shown a declining trend. The main responsible cancers are in the esophagus, stomach, liver, and lung. Through great efforts for prevention, obvious decrease for esophageal cancer and cervix cancer has been achieved, but the mortality rate for gastric cancer remains high.

**Key Words:** Malignant tumors - mortality rates over time - registry data

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### Introduction

With development of the social economy and improved sanitation, the disease profile of Chinese has changed greatly and malignant tumors have become more prevalent. Shexian county, which is located around the Taihang mountain in the southwest of Hebei province, is one of the high-incidence areas in China (Jun et al., 1995; Chinese Tumor Prevention Office, 2003; ShiXin et al., 1999). Since the 1970's, Shexian county has organized regular investigations of all causes of death from malignant tumors.

The county occupies an area about 1509 square kilometers, including 29 villages with a population of 383,284. There is a remarkable variation in the geography, from mountain to semi-mountain and the mean altitude is 890 meters. The rainfall is 570 millimeter per year and

average temperature is 14.5°C. The major soil is brown soil and tint meadow soil. Farm crops include millet, wheat, corn, rice, legume and red potato. Iron is the main mineral, and coal is the main local fuel of the county.

### Materials and Methods

Three massive investigations of all causes of death have been carried out in Shexian county by Hebei Cancer Institute in the 1970's, 1980's and 1990's, with an especial focus on malignant tumors. Data on malignant tumor incidence and mortality for the 21st century were obtained from the Cancer Registry of Shexian. Before each investigation, the provincial tumor prevention office designed the project, then printed questionnaires and statistic tables. After that, a training class was held and tasks were assigned. In order to guarantee

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**Table 1. Mortality Rates of Malignant Tumors in Each Decade (/100,000)**

	1970's	1980's	1990's	2000's	Total
<b>Males</b>					
Cases of death	1593	1588	1485	1410	6076
Mortality rate	320.2	309.1	261.6	236.4	279.3
Chinese standard rate	309.7	347.7	267.6	215.2	275.5
World standard rate	421.2	466.5	367.4	280.1	376.1
<b>Females</b>					
Cases of death	887	934	806	660	3287
Mortality rate	214.2	204.9	156.6	119.4	169.6
Chinese standard rate	215.2	228.2	162.0	107.5	168.1
World standard rate	291.2	314.2	219.7	145.0	227.8
<b>Total</b>					
Cases of death	2480	2522	2291	1350	9363
Mortality rate	272.0	260.1	211.7	180.1	227.5
Chinese standard rate	266.2	285.3	217.6	142.1	224.5
World standard rate	361.3	393.1	296.5	188.8	305.1

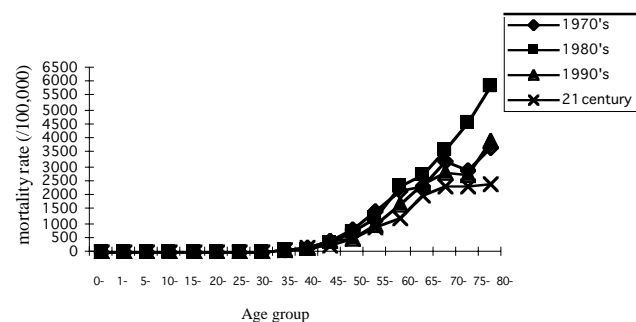
the quality, Shexian cancer institute organized a leading group associating with doctors of towns. Under the leading professors of the county, the doctor and cadre of each village (the first level of prevention) examined door to door for deaths in the population, then filled in medical certificates of death and reported then to health centers (the second level), and after calculation, these were transferred to the county tumor institute (the third level), where a check was made with regard to fulfillment of appropriate criteria and grade, then the data were input into a computer for generation of statistics.

We adopted the Chinese population structure for calculating the standard mortality rate of China and the standard population of world for calculating the standard mortality rate of the world. The direct method was employed for sex and age standardizing.

## Results

### Mortality Trend

The mortality rates are given in Table 1. From the 1970's to the beginning of the 21st century, the mortality rate has shown a descending trend ( $\chi^2 = 240.51$ ,  $p < 0.001$ ). Compared with the 1970's, the mortality rate of malignant tumors in the new century decreased by 92/100,000 or 33.8%. 1970's,



**Figure 1. Age Distribution of Fatalities from Malignant Tumors in Males of Shexian**

the mortality rate of malignant tumors in 21 century For males it was 26.2%, and for females 44.3%. (Figures 1 and 2).

### Sex Ratio

The mortality rate from malignant tumors in males was found to be consistently higher than in females (Table 2). Sex ratios (male vs female) in each decade were 1.5, 1.5, 1.7 and 2.0 with a trend towards increase.

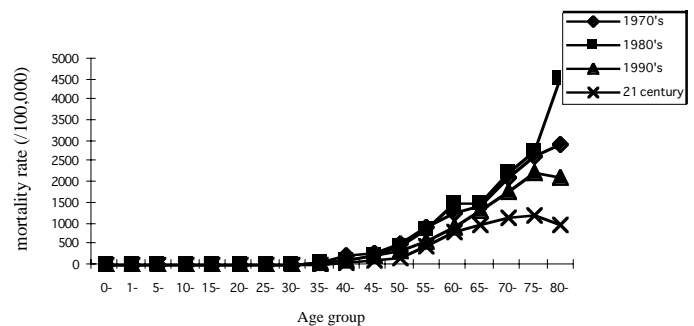
### Mortality Rates with Age

The trend with mortality rates were same in males and females. They were low before 35-years of age then increased gradually, reaching peaks at 80 years of age.

### Mortality Rates by Age Group

We divided the population into five groups: 0-15 year old group, 15-45 year old group, 45-55 year old group, 55-65 year old group and >65 year old group. In the first, the main malignant tumor was leukaemia and the mortality rate was 1.41/100,000, the percentage of all cancers being 62.1% (the mortality rate of males was 1.33/100,000 with a percentage of 52.9%; the mortality rate of females was 1.52/100,000 with a percentage of 75.0%).

In 15-45 year old group, the top five malignant tumors



**Figure 2. Age Distribution of Fatalities from Malignant Tumors in Females of Shexian**

were esophageal cancer (7.7/100,000), gastric cancer (7.77/100,000), liver cancer (3.3/100,000), leukaemia (2.9/100,000), intestines and rectum cancer (2.1/100,000), accounting for 23.6%, 23.5%, 10.2%, 8.9% and 6.3%, respectively. In males, the top five malignant tumors were esophageal cancer (9.9/100,000), gastric cancer (9.8/100,000), liver cancer (4.0/100,000), leukaemia (2.8/100,000), and intestines and rectum cancer (2.2/100,000), with percentages of 29.0%, 28.7%, 11.7%, 8.2% and 6.5%; in females, they were esophageal cancer (5.3/100,000), gastric cancer (5.3/100,000), cervix cancer (3.7/100,000), leukaemia (3.0/100,000), and intestines and rectum (1.9/100,000), the percentages were 17.2%, 17.2%, 11.8%, 9.8% and 8.5%.

In 45-55 year old group, the top five were esophageal cancer (138.1/100,000), gastric cancer (126.7/100,000), liver cancer (30.2/100,000), lung cancer (5.04/100,000) and cervix cancer (16.96/100,000), with percentages of 36.8%, 34.3%, 8.0%, 5.0% and 4.5%, respectively. In males, they were gastric cancer (174.9/100,000), esophageal cancer (174.0/100,000), liver cancer (42.27/100,000) intestines and rectum cancer (9.0/100,000 and lung cancer (22.9/100,000), with percentages of 39.3%, 39.1%, 9.5%, 5.2% and 2.0% in turn. In females, the top five malignant tumors were esophageal cancer 93.48/100,000, gastric cancer 66.61/100,000, cervix cancer 38.06/100,000, liver cancer 15.11/100,000 and lung cancer 13.99/100,000, with percentages 32.36%, 24.81%, 13.18%, 5.23% and 4.84% in turns.

In 55-65 year old group, the top five malignant tumors were gastric cancer (485.6/100,000), esophageal cancer (481.7/100,000), liver cancer (59.8/100,000), lung cancer (43.3/100,000) and cervix cancer (34.0/100,000), with

percentages 40.6%, 43.1%, 5.0%, 3.7% and 2.9%. In males, the top five malignant tumors were esophageal cancer (598.3/100,000), gastric cancer (596.9/100,000), liver cancer (71.01/100,000), lung cancer (4.03/100,000) and intestines and rectum cancer (18.09/100,000), with percentages of 48.0%, 42.4%, 5.0%, 4.0% and 1.3% in turns. In females, the top five malignant tumors were esophageal cancer (335.0/100,000), gastric cancer (284.3/100,000), cervix cancer (76.8/100,000), liver cancer (45.6/100,000) and lung cancer (2.9/100,000), with percentages of 37.2%, 33.6%, 8.5%, 5.1% and 2.9% in turn.

In the >65 year old group, the top five malignant tumors were esophageal cancer (997.8/100,000), gastric cancer (852.9/100,000), liver cancer (111.0/100,000), lung cancer (85.2/100,000) and intestines and rectum cancer (40.8/100,000), with percentages of 47.8%, 39.6%, 5.3%, 4.1% and 1.1% in turn. In males, the top five malignant tumors were esophageal cancer (1163.47/100,000), gastric cancer (1091.40/100,000), liver cancer (141.06/100,000), lung cancer (114.29/100,000) and intestines and rectum cancer (53.54/100,000), with percentages of 43.5%, 40.4%, 5.3%, 4.3% and 2.0% in turn. In females, the top five malignant tumors were esophageal cancer (827.03/100,000), gastric cancer (606.2/100,000), liver cancer (79.6/100,000), lung cancer (55.2/100,000) and cervix cancer (53.1/100,000, and lung cancer (2.9/100,000), with percentages of 55.8%, 38.1%, 5.4%, 3.7% and 3.6%, respectively.

*Mortality Trend of Main Cancers*

As shown in Table 3, we obtained evidence that the mortality rates of esophageal cancer and cervix cancer have been descending over the last few decades. With esophageal

**Table 2. Age and Gender Distribution of Mortality Rates from Malignancies in SheXian,China (/100,000)**

Age group	1970's			1980's			1990's			2000's			Total		
	Male	Female	Sex ratio	Male	Female	Sex ratio	Male	Female	Sex ratio	Male	Female	Sex ratio	Male	Female	Sex ratio
0-	0.0	24.6		8.7	0.0		9.9	0.0		0.0	0.0		5.7	3.4	1.7
1-	7.8	6.2	1.2	2.9	6.3	0.4	0.0	3.4		0.0	0.0		2.3	4.0	0.6
5-	0.0	0.0		1.9	2.1	0.9	0.0	0.0		2.0	0.0		0.9	0.5	1.7
10-	6.4	2.0	3.2	1.6	3.4	0.5	4.9	0.0		0.0	1.4		2.8	1.8	1.6
15-	5.9	7.7	0.8	7.2	11.4	0.6	3.5	5.4	0.6	1.9	0.0		4.6	6.2	0.7
20-	6.5	7.0	0.9	6.9	14.7	0.5	16.6	7.4	2.2	12.0	0.0		10.7	7.7	1.4
25-	10.7	0.0		13.3	24.5	0.5	14.6	10.9	1.3	14.2	8.1	1.8	13.3	11.2	1.2
30-	10.6	22.1	0.5	26.6	23.4	1.1	26.5	19.0	1.4	25.8	10.7	2.4	23.6	17.7	1.3
35-	57.6	47.0	1.2	65.9	68.1	0.9	48.2	45.5	1.1	54.6	27.7	2.0	55.9	43.2	1.3
40-	177.1	212.2	0.8	98.1	124.9	0.8	134.5	102.4	1.3	121.1	52.6	2.3	131.2	108.3	1.2
45-	381.8	284.7	1.3	310.7	255.0	1.2	367.7	209.9	1.8	219.8	101.7	2.2	308.8	190.9	1.6
50-	763.4	501.0	1.5	723.1	480.7	1.5	514.7	340.5	1.5	464.0	195.7	2.4	606.7	348.3	1.7
55-	1409.1	944.6	1.5	1196.8	840.6	1.4	989.2	567.3	1.7	897.7	444.9	2.0	1114.3	681.9	1.6
60-	2130.8	1245.3	1.7	2293.2	1512.8	1.5	1703.9	907.9	1.9	1223.7	799.2	1.5	1788.9	1093.4	1.6
65-	2345.2	1461.1	1.6	2698.8	1494.7	1.8	2419.2	1315.9	1.8	2027.6	984.3	2.1	2341.2	1286.1	1.8
70-	3222.5	2109.1	0.2	3626.0	2225.4	1.6	2801.4	1765.0	1.6	2362.3	1140.7	2.1	2927.9	1742.0	1.7
75-	2907.4	2638.6	1.1	4550.7	2780.5	1.6	2759.4	2265.3	1.2	2357.4	1191.2	2.0	3016.1	2043.5	1.5
80-	3661.2	2959.5	1.2	5860.8	4529.0	1.3	3966.2	2133.3	1.8	2421.2	963.0	2.5	3649.4	2111.7	1.7
Total	320.2	214.2	1.5	309.1	204.9	1.5	261.6	156.6	1.7	236.2	119.4	2.0	279.3	169.6	1.6

cancer the rank declined from No 1 to No 2. Cervix cancer dropped from No 3 to No 4. The mortality rate of gastric cancer, in contrast, increased slightly then decreased, the rank ascending from the second in 1970's and 1980's to the first in 1990's and 21 century. The main reason was the obvious descending mortality rate with esophageal cancer.

With other cancers, for example in the liver, lung, intestine and rectum, fluctuation was not consistent.

#### Geographical Distribution

The distribution of malignant tumors in Shexian county demonstrated some geographic variation, high mortality towns being centralized in the area where the Qing zhang and Zhuozhang Rivers join, for instance Guxin, Zhangjiatou, Huyu and Shentou, rates being above 250/100,000, in contrast to the values below 200/100,000 for towns far away from the Zhang river as Qingta, Mujing, Wangjinzhuang, and Zhangjiazhuang.

Esophageal and gastric cancers demonstrated the most pronounced geographical distribution.

## Discussion

#### Overall Mortality Rate

Shexian county is in the high incidence area of China. The mean mortality rate from 1970's to the 21st century was 227.52/100,000 and higher than mean level for China (Zhangwenkang, 2002; Lian et al., 1997; Lian et al., 2002).

#### Changing Mortality Rates Over Time

The mortality rate of malignant tumor had a trend of descend, as reported earlier for esophageal cancer (Jun et al., 2003). It mostly benefited from education and improved sanitation with advocacy of "early detection, early diagnosis, early treatment" (Xin et al., 1988; Jun et al., 1996). The obvious decline of cervix cancer, appeared to be linked to cytological examination.

The reason why the mortality rate for gastric cancer did

not appreciably change remains to be clarified. Correas proposed that the pathogenesis of gastric cancer is due to excessive consumption of salt, lack of vitamin C and  $\beta$  carrot element, infection of pylorus bacterium (The Eurogast Study Group, 1993).

Much research inside and outside China has found that the mortality rate of intestine and rectum cancers is on the increase (Parkin et al., 1993; DeHong and LeFeng, 1998). In our research this change was not apparent, the reason possibly being that the economic level is low in Shexian, and the residents eat much flour and little meat.

#### Obvious Geographical Distribution

The distribution of malignant tumors centralized in the area where Qingzhang and Zhuozhang Rivers join. This might point to the existence of carcinogen contamination and we found that some microelements may be lacking in this area (Guang et al., 1998). However, the exact reason for the geographical variation remains to be elucidated.

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**Table 3. The Mortality Rates of Individual Malignant Tumors in Each Decade**

	1970s			1980s			1990s			2000s			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
Esophageal cancer	164.4	91.3	131.3	130.6	77.0	105.4	94.8	56.0	76.3	82.8	46.3	65.2	115.5	65.7	92.2
Gastric cancer	105.5	60.4	85.0	119.9	61.4	92.4	112.7	55.8	85.6	110.6	45.6	79.3	112.8	55.2	85.3
Liver cancer	17.9	8.2	13.5	24.9	12.7	19.2	23.1	9.9	16.8	15.9	6.9	11.6	20.4	9.3	15.2
Lung cancer	11.7	4.6	8.5	11.7	6.8	9.4	13.9	8.4	11.3	11.1	4.3	7.8	12.1	6.1	9.3
Cervix cancer	0.0	27.8	12.6	0.0	23.3	10.9	0.0	10.5	5.0	0.0	6.7	3.2	0.0	16.1	7.6
Ovarian cancer	0.0	4.6	2.1	0.0	2.9	1.3	0.0	2.7	1.3	0.0	1.1	0.5	0.0	2.7	1.3
Intestine and rectum cancer	6.6	5.6	6.1	8.2	5.9	7.1	4.9	3.5	4.3	3.2	2.2	3.0	5.6	4.3	5.0
Leukaemia	2.2	2.4	2.3	2.5	5.7	4.0	3.2	2.9	3.1	1.8	0.9	1.4	2.4	2.9	2.7
Others	11.9	9.4	10.7	11.3	9.2	10.3	18.9	7.0	8.0	11.1	5.4	8.1	10.5	7.4	9.0

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