

Analysis of Mortality of Stomach Cancer in China from 1990~1992

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This work was supported by the National Important Medicine Technology "The Eighth Five- Years" Foundation.

OBJECTIVE To assess the impact of stomach cancer on the Chinese population by epidemiological analysis of its distributional mortality.

METHODS Data from 1990–1992 on stomach cancer mortality collected by a sampling survey involved one tenth of the total Chinese population.

RESULTS The crude mortality rate of stomach cancer in China was 25.2 per 10⁵ (32.8 per 10⁵ for males and 17.0 per 10⁵ for females), which comprised 23.2% of the total cancer deaths from 1990 to 1992, making stomach cancer the leading cause of cancer death. The stomach cancer mortality rate of males was 1.9 times of that of females. The Chinese mortality rates of stomach cancer adjusted by the world standard population were 40.8 per 10⁵ and 18.6 per 10⁵ for males and females, which were 4.2–7.9 (for males) and 3.8–8.0 (for females) times of those in developed countries. Age-adjusted mortality rates of stomach cancer in China have distinct geographical differences: from the lowest of 2.5 per 10⁵ to the highest of 153.0 per 10⁵ in the 263 selected sites, and 15.3 per 10⁵ in urban areas and 24.4 per 10⁵ in rural areas, a difference of 1.6 times.

CONCLUSION The prevention and treatment of stomach cancer in China, especially in the countryside and the under-developed areas in the northwest, should be a long-term focus in preventing of cancers of the digestive system. Urgent measures for prevention and early detection of stomach cancer should be taken.

KEYWORDS: stomach neoplasms/mortality, stomach neoplasms/epidemiology, China.

A ccording to a 1990-1992 sampling survey that involved one tenth of the total Chinese population, stomach cancer in China was the leading cause of deaths from cancer in both genders. The survey results showed that cancer deaths of the digestive system accounted for 63% of all cancer deaths in China and of these, 37% occurred in stomach. The mortality from stomach cancer in China was analyzed in this report.

MATERIALS AND METHODS

Data

Data from a sampling survey of the causes of death involving one tenth of the total Chinese population during 1990~1992 were collected by The National Cancer Research and Control Office. The sampling survey was conducted in two stages, namely, cluster and stratified randomized sampling methods with a 10% sampling proportion.

Received May 21, 2004; accepted August 10, 2004.

Chinese Journal of Clinical Oncology
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Twenty-seven provinces, cities, autonomous regions and municipalities were selected for the first stage, and then from these areas 263 randomly selected sites were surveyed (74 cities, 189 counties). Data related to the death of all subjects in the 263 selected sites during 1990~1992 were collected, including demographics, causes of death and diagnostic features. Data concerning population size and numbers of new births in the sites were collected at the same time.

Comparison was conducted with a sampling survey and population and assessment of the population for total causes of death and cancer deaths in the 1970s. The results indicated that the proportion of all kinds of cancer deaths in sites relative to total deaths was consistent with that in the whole country, so the sample can be viewed as a good representative of the total population. The numbers of deaths found in the survey study were higher than those published in the local police annals by 4.82% over the corresponding periods. Hospitals of different levels reported 90.98% of the cases of cancer deaths.^[1] Mortality data from stomach cancer was classified according to the ICD-9 (International Classification of Diseases, the ninth edition), including cardiac portion, pylorus, pyloric antrum, fundus, body, lesser curvature, and greater curvature of the stomach and NOS (not otherwise specified).

Statistical methods

The mortality rates adjusted by the 1982 China standard population and the 1985 world standard population published by WHO were calculated. The upper limit of the standardized life-eliminated rate was defined as 75 years old. The cumulative mortality rates were calculated with ages 0~74 as well as the truncated age-adjusted mortality rates with ages 35~64.

RESULTS

Stomach mortality rate

The stomach cancer mortality rate from selected sites during 1990~1992

The overall death rate of stomach cancer in China was

25.2/10⁵ and based on gender, 32.8/10⁵ in males and 17.0/10⁵ in females. It was the most common cause of cancer deaths, comprising 23.2% of the total cancer deaths, and the most malignant tumor threatening human health. The risk of stomach cancer was higher in males than in females, the crude death rate being 0.9 times higher in males than in females. Concerning the influence on lifetime longevity, the standardized life-eliminated rate was 0.14%, being 0.2% in males and 0.09% in females, the rate of which in males was 2.2 times of that of females (Table 1).

Distribution of stomach cancer deaths in selected sites

The ranges of the adjusted mortality rate were 2.5/10⁵~153.0/10⁵ in 263 selected sites of the whole country, the maximum being 61 times higher than the minimum. The adjusted rates were lower in the majority of sites, as there were 89.4% selected sites where the rates were under 40/10⁵, and only 6.8% selected sites where the rates were over 50/10⁵. The stomach cancer adjusted mortality rate had a positive skewed distribution. The lowest adjusted mortality rate for females was 1/10⁵ while that for males was 2.9/10⁵. The highest adjusted mortality rate for females was 92.9/10⁵ while that for males was 209.8/10⁵. The average adjusted mortality rate in China was 21.8/10⁵, and 13.8/10⁵ for females and 30.1/10⁵ for males. The results showed that there were 62.7% of the sites (165 sites) being lower than the average level, 21.8/10⁵ (30.1/10⁵ for males, 13.8/10⁵ for females), by comparing the sample to the population for adjusted mortality rates.

Comparison of the stomach cancer mortality rate with other countries

The rate was higher in China than in other countries world-wide. The mortality rate adjusted by the world standard population in Asia was highest in China and Japan followed by Russia, and the third was Middle Europe, Northern Europe and Western Europe. The rates were very low in the majority of developed countries, under 10/10⁵ for males and 5/10⁵ for females on average. The rate of males was 3.2~6.9 times higher in China than in the western developed countries, while that of females was 2.8~7.0 times higher. The

Table 1. Stomach cancer deaths in China and other countries or areas in the early 1990s

Country	Sex	Total unadjusted mortality(1/10 ⁵)	Adjusted-rate with Chinese population (1/10 ⁵)	Adjusted-rate with the world population (1/10 ⁵)	Proportion(%)	Rank	Truncated age-adjusted mortality rates (1/10 ⁵)	Cumulative mortality (%)	Standardized life-eliminated rate(%)	Median of death age
China	Total	25.2	21.8	29.3	23.2	1	44.7	3.7	0.14	65.1
	Male	32.8	30.1	40.8	24.3	1	60.9	5.2	0.20	64.5
	Female	17.0	13.8	18.6	21.3	1	27.2	2.3	0.09	66.4
Cities	Total	19.4	15.3	20.8	17.3	3	27.6	2.6	0.10	
	Male	25.2	21.2	29.1	18.0	3	37.3	3.6	0.13	
	Female	13.2	9.8	13.2	15.9	2	17.3	1.6	0.07	
Countryside	Total	27.2	24.4	32.8	25.4	1	51.9	4.2	0.16	
	Male	35.5	33.7	45.6	26.7	1	70.8	5.8	0.22	
	Female	18.3	15.4	20.8	23.2	1	31.5	2.6	0.10	
Hongkong	Male	11.5		10.5	6.1	4				
	Female	7.6		5.6	6.3	5				
Russia	Male	42.8		40.4	18.0	2				
	Female	29.7		16.9	17.9	1				
Kazakhstan	Male	25.9		35.7	16.5	2				
	Female	17.9		16.1	15.8	1				
Japan	Male	49.4		30.8	21.1	2				
	Female	27.5		13.4	18.5	1				
Poland	Male	23.5		20.5	10.1	2				
	Female	12.0		7.3	7.3	3				
Singapore	Male	16.1		19.2	11.3	2				
	Female	8.4		8.0	8.2	4				
Austria	Male	23.4		15.5	9.2	3				
	Female	20.1		7.7	8.6	3				
Germany	Male	21.7		13.8	7.9	4				
	Female	19.7		7.3	7.7	3				
USA	Male	7.0		5.2	3.1	4				
	Female	4.4		2.3	2.3	5				

proportion of the stomach cancer deaths to the total malignant tumor deaths was slightly higher among males than among females in the majority of countries world-wide.

The proportions in both genders were highest in China compared to the rest of the world, 24.3% for males and 21.3% for females, followed by Japan. The proportion of stomach cancer deaths to total cancer deaths was under 10% for most western developed countries, especially in France, Canada, Australia and America, being under 5%.^[2]

Population distribution of stomach cancer deaths in China

The sex and age-specific mortality rates of stomach cancer

Mortality rates were found to increase with advancing age. Stomach cancer in children under 15 is very rare, the mortality rates were under 1/10⁵ for ages 15~24. The rates then increased continuously from ages 25 to 74, with the highest rate of 245.7/10⁵ occurring at the age of 75 after which the rate slightly decreased. Tendencies were similar for both genders. The rates were higher in males than in females in all age groups except for the

25~29 age group, and the degrees of increase in the rate were all larger in males than in females. The differences in rates by sex increased with advancing age from 30 to 59, as did as the sex ratio from 1.2 to 2.5, but at older ages the ratio decreased gradually (Table 2).

The male/female age-specific mortality rates increase sharply from the age of 35 to 49, while for those in older age groups there was a moderate increased (Table 2). The proportion of stomach cancer deaths to total cancer deaths increased with advancing age, namely, 14.8% for ages 30~44, 23.3% for ages 45~64 and 26.7% for ages older than 65.

Table 2. The 1990–1992 sex and age-specific mortality of stomach cancer in China (1/10⁵)

Age group	Male	Female	Total	Sex ratio
total	32.8	17.0	25.2	1.9
0-14	0.0	0.0	0.0	0.0
15-19	0.3	0.2	0.2	1.7
20-24	0.8	0.7	0.7	1.1
25-29	1.5	1.6	1.5	0.9
30-34	3.3	2.7	3.0	1.2
35-39	7.3	5.6	6.5	1.3
40-44	17.6	9.5	13.7	1.8
45-49	35.5	18.0	27.2	2.0
50-54	63.8	28.8	47.1	2.2
55-59	114.0	46.4	81.5	2.5
60-64	187.5	79.0	134.7	2.4
65-69	258.3	112.1	184.1	2.3
70-74	349.6	154.8	245.4	2.3
75-79	352.1	165.5	245.7	2.1
80-84	340.0	176.2	237.9	1.9
85+	312.2	161.1	208.0	1.9

Distribution of stomach cancer deaths by age and sex, the average death age and the influence of stomach cancer death on longevity

There was a tendency for the proportion of stomach cancer deaths to be high in both genders in the middle-age group and low in both genders in the younger and older age groups because there was a difference for the age distribution of the population and mortality rates among age groups. With advancing age the proportion of deaths due to stomach cancer increased, and it was the highest in the 65~69 age

group, and then decreased in older ages. The proportion of deaths in the older groups to the total age group was far higher than that of the younger groups, only 3.9% under the age of 40, while 80% over the age of 55 and 67.3% over the age of 60. The median age of death from stomach cancer was 65.1 (64.5 in males and 66.4 in females).

Standardized life-eliminated rate was 0.14% on average (0.2% in males and 0.09% in females). It was 2.2 times higher in males than in females. These results indicate that the gender difference in overall longevity influence stomach cancer deaths influences.

The mortality rate distribution in urban and rural areas for stomach cancer

There were distinct differences among urban and rural areas, as there were in gender. The adjusted mortality rate in cities was 15.3/10⁵ (21.2/10⁵ in males and 9.8/10⁵ in females), and 24.4/10⁵ in the countryside (33.7/10⁵ in males and 15.4/10⁵ in females). Consequently the area ratios for males for the adjusted mortality rates was 0.6 (that of rural areas as the denominator) as well as for females.

There also was a significant difference for the rank of stomach cancer in total cancer deaths comparing cities to rural areas. The stomach cancer mortality rate ranked third for males in cities (the proportion of death to total cancer deaths being 18.0%) and the first in the countryside (the proportion of deaths to total cancer deaths being 26.7%). The stomach cancer mortality rate ranked second for females in cities (the proportion of deaths to total cancer deaths being 15.9%) and first in countryside (the proportion of deaths to total cancer deaths being 23.2%). The statistical data indicate that prevention and treatment of stomach cancer is of more importance in the countryside than in the cities.

The geographical distribution of the mortality rate of stomach cancer in 27 provinces

The total unadjusted mortality rates in males, females and total were all highest in Gansu province and lowest in Yunnan province. While the adjusted rate for males was 8.0/10⁵ in Yunnan and 96.5/10⁵ in Gansu, 4.5/10⁵ in Beijing for females, and 44.8/10⁵ in Gansu province.

Table 3. 1990–1992 mortality of stomach cancer in provinces, cities and autonomous regions (1/10⁵)

Province or City	Male					Female					Total				
	Mortality	Adjusted-rate with Chinese population	Proportion (%)	Rank		Mortality	Adjusted-rate with Chinese population	Proportion (%)	Rank		Mortality	Adjusted-rate with Chinese population	Proportion (%)	Rank	
China	32.8	30.1	24.3	1		17.0	13.8	21.3	1		25.2	21.8	23.2	1	
Beijing	19.9	14.1	18.5	2		7.0	4.5	9.4	3		13.5	9.1	14.8	3	
Tianjin	22.3	14.3	15.4	2		9.9	5.9	9.8	2		16.0	9.9	13.1	2	
Hebei	34.8	32.3	24.3	2		16.6	14.1	19.5	2		26.0	23.0	22.6	2	
Shanxi	66.5	59.9	35.6	1		35.1	28.9	27.9	1		51.5	44.4	32.7	1	
Neimeng	27.1	23.0	21.6	2		9.6	8.8	17.7	2		18.8	16.6	20.5	2	
Liaoning	37.0	31.9	24.1	2		17.1	14.7	19.5	2		27.3	23.6	22.4	2	
Jilin	29.8	29.3	23.4	3		13.3	13.5	18.5	2		21.7	21.8	21.7	3	
Heilongjiang	24.3	24.6	20.2	3		14.5	15.1	17.2	3		19.5	20.0	19.0	3	
Shanghai	53.8	29.9	22.7	2		30.7	14.5	20.5	1		42.3	21.5	21.9	2	
Jiangsu	41.8	33.2	21.3	2		24.5	16.1	20.2	2		33.3	24.1	20.9	2	
Zhejiang	41.8	34.2	27.3	1		18.6	13.5	22.1	1		30.5	23.7	25.5	1	
Anhui	49.4	47.5	31.5	1		25.7	21.4	28.3	1		38.1	34.0	30.4	1	
Fujian	41.8	43.6	26.0	1		21.2	18.0	23.6	1		31.8	30.1	25.2	1	
Jiangxi	21.7	22.5	24.6	2		11.2	10.7	21.0	1		16.7	16.7	23.3	1	
Shandong	38.2	33.7	25.8	1		20.6	15.4	23.1	1		29.6	24.1	24.8	1	
Henan	42.2	42.4	30.0	1		24.7	20.3	26.7	2		33.7	30.7	28.7	2	
Hubei	26.4	23.1	21.0	2		13.6	10.2	19.4	1		20.2	16.4	20.5	1	
Hunan	14.7	13.8	19.6	2		7.9	7.0	15.5	1		11.4	10.4	18.0	2	
Guangdong	20.4	19.1	14.3	4		10.6	8.1	13.5	3		15.6	13.2	14.0	4	
Guangxi	15.0	15.0	14.5	3		8.2	7.2	15.1	2		11.8	11.0	14.7	2	
Hainan	17.3	21.1	16.7	3		8.4	7.9	20.9	1		13.1	13.9	17.8	3	
Sichuan	22.1	20.2	18.4	3		12.1	9.9	18.3	2		17.2	14.9	18.3	3	
Guizhou	14.2	15.1	19.8	3		8.3	8.2	19.6	1		11.3	11.6	19.7	1	
Yunnan	9.0	8.0	11.1	3		6.9	5.9	12.7	2		7.9	7.0	11.7	3	
Shannxi	38.7	37.0	28.7	1		17.2	16.3	22.3	1		28.4	27.1	26.5	1	
Gansu	90.8	96.5	51.4	1		41.1	44.8	41.9	1		66.7	71.7	48.2	1	
Ningxia	35.7	33.6	33.8	1		13.7	12.6	26.5	1		25.1	23.4	31.5	1	

The ratio of the maximum to the minimum for the total unadjusted mortality rates was 8.4:1 (males: 10.1:1, females: 6.0:1), and the ratio for adjusted mortality rates was 10.3:1 (males: 12.1:1, females: 9.9:1).

Some provinces had higher adjusted rate in males compared with the average level, including Gansu, Shanxi, Anhui, Fujian, Henan, Shaanxi, Zhejiang, Shandong, Ningxia, Jiangsu, Hebei and Liaoning province, and in females including Gansu, Shanxi, Anhui, Henan, Fujian, Shaanxi, Jiangsu, Shandong, Heilongjiang, Liaoning, Hebei and Shanghai municipality.

The range of the proportion of stomach cancer deaths to total cancer deaths was from 11.1% (Yunnan province) to 51.4% (Gansu province) in males, from 9.4% (Beijing) to 41.9% (Gansu province). The proportion ranked first in a group of 11 provinces (or cities), such as Gansu and Shanxi province etc., and the second, in a group of 9 provinces (or cities), such as Henan and Hebei province while it ranked the third in 6 provinces (or cities) including Jilin and Heilongjiang province, the fourth in Guangdong province (Table 3).

The order of mortality rates of stomach cancer in regions in China from high to low was the northwest,

Table 4. A list of counties with adjusted mortality rate by Chinese population 2 times higher than that on average

Male > 60.2/10 ⁵			Female > 27.6/10 ⁵			Total > 43.5/10 ⁵		
County	Mortality	Adjusted-rate	County	Mortality	Adjusted-rate	County	Mortality	Adjusted-rate
Tianchang	77.3	66.7	Yanting	40.8	31.1	Yanting	52.1	43.6
Xianju	77.3	69.4	Putian	46.0	34.8	Xianju	54.0	45.8
Wudu	82.2	70.8	Tianchang	48.1	36.4	Tianchang	63.0	51.4
Putian	73.0	75.7	Huaian	38.5	37.0	Putian	58.8	52.1
Linxian	72.6	81.1	Jiyuan	44.6	38.3	Wudu	58.5	52.4
Neixiang	97.3	92.3	Neixiang	54.0	40.0	Linxian	58.6	60.1
Jiyuan	88.0	95.3	Zhangye	38.1	41.9	Jiyuan	66.6	63.9
Zhangye	89.3	97.0	Linxian	44.1	42.1	Neixiang	77.5	65.9
Jiaxian	92.3	101.8	Zanhuang	43.6	45.1	Zhangye	64.4	70.2
Tianzhu	77.0	104.2	Linze	37.6	45.6	Jiaxian	64.4	71.8
Pingshun	119.1	108.9	Lujiang	51.6	47.6	Tianzhu	59.2	78.3
Linze	94.3	112.9	Yuanqu	49.2	48.6	Linze	66.7	80.2
Shexian	112.7	115.0	Tianzhu	39.1	50.1	Yuanqu	74.2	80.6
Yuanqu	96.9	116.7	Changle	54.3	51.2	Lujiang	84.5	82.5
Lujiang	114.8	122.5	Shexian	55.8	58.1	Zanhuang	77.7	83.2
Zanhuang	110.1	124.0	Yangcheng	72.7	60.6	Pingshun	97.0	87.5
Yangcheng	134.0	134.6	Pingshun	72.9	65.3	Shexian	85.6	88.3
Changle	127.5	157.7	Wuwei	69.0	92.9	Yangcheng	104.0	94.8
Wuwei	165.0	209.8				Changle	93.4	100.9
						Wuwei	117.8	153.0

north, east, northeast, mid-south and southwest of China. The findings indicate that the mortality rates are associated with different geographic regions.

The stomach cancer mortality distribution in counties with a high mortality rates

The definition of a county with a high mortality was that its mortality rate was double the average rate of China, i.e. the county rate was over 60.2/10⁵ for males, and over 27.6/10⁵ for females (Table 4).

There were 19 high mortality counties for males, and 18 counties for females. The proportions of these counties to all selected sites based on the mortality rates were 7.2% and 6.8% in males and females respectively. The age-adjusted mortality rate ranked first in Wuwei county, Gansu province, being 209.8/10⁵ for males and 92.9/10⁵ for females. This rate was 7 and 6.7 times of the average level respectively. These counties with high mortality were located in 8 provinces, and there was a similar tendency for both sexes in these 6 provinces

mentioned above, such as Gansu, Shanxi, Henan, Hebei, Fujian and Anhui province, except Zhejiang and Shaanxi province only for males, and Jiangsu and Sichuan province only for females. In the same high rate county, Pingshun county, Shanxi province had the lowest sex ratio of adjusted mortality rates for stomach cancer being 1.7:1 (male/female), and Changle county, Fujian province had the highest sex ratio being 3.1:1 (male/female). The sex ratios adjusted mortality rate for stomach cancer in 69% of counties (11) was 2.1~2.8, and others were 1.8~2.0.

DISCUSSION

This survey indicated that stomach cancer is the most common cause of cancer deaths in both genders. In comparing the adjusted mortality rate in the 90's with that in the 70's of the last century there was a similar rate of stomach cancer, although the crude rate was a little higher in the 90's than in the 70's.^[3] Now it needs to

be pointed out that cardia cancer in this survey was classified into stomach cancer while in the 1970's, it was classified into esophageal cancer. Perhaps the total mortality rate for stomach cancer would appear lower in China if this survey excluded cardia cancer. Pollock et al.^[4] reported that the outstanding character for stomach cancer epidemiology was a decreasing tendency of the incidence and mortality rate. There was little change in the proportion of stomach cancer deaths to total cancer deaths in the 1990s. There was a difference among the provinces regarding changes of adjusted mortality rates for stomach cancer, in Beijing, Tianjin, Shanghai, Hubei province and the Ningxia Hui autonomous region having a large decrease. But there were little changes in the ranking of stomach cancer to the numbers of total cancers when one compares the two periods in the above-mentioned provinces. However, the ranking in some other provinces for females was on the increase. The death rate rankings were all within the first to the third up to the 1990s (except Guangdong province).

The mortality rate for stomach cancer is higher in China than in other countries, especially western developed countries, and the proportion of stomach cancer deaths is also higher.

The geographical distribution of the mortality rate for stomach cancer is associated with the economic level of different regions, which is confirmed by the difference found between cities and rural areas. There is a similar tendency in other countries.

In short, stomach cancer perhaps is closely related to dietary habits, economic level, geographic

environment, and so on. The reason for the increase in the mortality rate in the countryside is due to a decrease in the infection mortality rate, improved economical level, health services, better cancer diagnosis, and an aging population.^[5] The mortality rate in cities still ranked within the third, though it was lower in cities than in rural areas.

Digestive system cancer is a serious threat to human health in China. Above the age of 45, the mortality rate of stomach cancer ranked first of total cancers. The prevention and treatment of stomach cancer in China, especially in the countryside and the under-developed areas in the northwest, should be a long-term focus for controlling of cancers of the digestive system. Urgent measures for prevention and early detection of stomach cancer should be taken.

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