RESEARCH ARTICLE

Mortality of Major Cancers in Guangxi, China: Sex, Age and Geographical Differences from 1971 and 2005

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Abstract

The incidence and mortality rates of liver and nasopharyngeal cancer in Guangxi province of China have always been among the highest in the world, and cancer is one of the major diseases that pose a threat to the health of residents in Guangxi. However, no systematic study has been performed to evaluate the time trends in the structure of cancer-related deaths and cancer mortality. In this study, we reveal sex, age and geography differences of cancers mortality between three death surveys (1971 to 1973, 1990 to 1992, and 2004 to 2005). The results show that the standardized mortality rate of cancer in Guangxi residents has risen from 43.3/100,000 to 84.2/100,000, the share of cancer deaths in all-cause deaths has increased from 13.3% to 20.7%, and cancer has become the second most common cause of death. The five major cancers, liver cancer, lung cancer, gastric cancer, nasopharyngeal cancer and colorectal cancer, account for 60% of all the cancer deaths. Cancers with growing mortality rates over the past 30 years include lung cancer, colorectal cancer, liver cancer and female breast cancer, of which lung cancer is associated with the sharpest rise in mortality, with a more than 600% rise in both men and women. Cancer death in Guangxi residents occurs mainly in the elderly population above 45 years of age, especially in people over the age of 65. The areas with the highest mortality rates for liver cancer and nasopharyngeal cancer, which feature regional high incidences, include Chongzuo and Wuzhou. Therefore, for major cancers such as liver cancer, lung cancer, gastric cancer, nasopharyngeal cancer and female breast cancer in Guangxi, we can select high-risk age groups as the target population for cancer prevention and control efforts in high-prevalence areas in a bid to achieve the ultimate goal of lowering cancer mortality in Guangxi.

Keywords: Cancer - mortality - Guangxi - China - 1971-2005

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Introduction

Data on causes of death shed light on the health status of people in a certain country or region and the severity of the threat of various diseases to human life, thus providing an important reference point for developing healthcare policies and strategies. In China, information on causes of cancer death is mainly collected through cancer registries. According to the Chinese Cancer Registry Annual Report 2012, a total of 104 cancer registries in China reported the 2009 cancer registration data in 2012, including 72 registries whose data quality passed comprehensive inspection1. These data reflect the incidence and mortality of cancers in the regions covered by the registries, involving a population of about 85.47 million and covering 31 urban areas (57.49 million) and 41 rural areas (27.98 million) (He et al., 2012). However, given China's population of 1.3 billion, further assessment is needed to examine how representative the combined data of the regional cancer registries are for cancer incidence and mortality nationwide (Zheng et al., 2012; Moore, 2013). Moreover, there are only two tumor registries in Guangxi, covering a population of about 1.24 million, which accounts for 2.7% of the total population in Guangxi, suggesting poorer representation of the registration data on cancer incidence and mortality in Guangxi.

Fortunately, the Chinese Ministry of Health and China's Cancer Prevention and Treatment Center have conducted three retrospective surveys on causes of death nationwide in the past 30 years, including the cause-of-death survey in the Chinese population from 1971 to 1973, and the cause-of-death sampling surveys in Chinese residents from 1990 to 1992 and from 2004 to 2005. These data offer a representative picture of cancer deaths in China over the same periods. Using the findings from the 1971-1973 survey, China produced its first cancer distribution map, revealed regional high

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Table 1. Overall Characteristics of Cancer Mortality in Guangxi over the Past 30 Years

	No. of deaths	Mortality (1/100,000)	SMR in China[a] (1/100,000)	SMR in world[b] (1/100,000)	Cumulative risk (%)	Constituent risk (%)
1971-1973						
Men	18341	49.22	57.46	77.18	7.56	—
Women	9698	27.03	29.49	39.66	4.05	—
Total	28039	38.34	43.26	58.04	5.76	—
1990-1992						
Men	7194	103.60	98.79	179.49	18.73	15.51
Women	3518	54.61	51.53	85.56	8.84	10.34
Total	10712	80.02	76.15	131.64	13.65	13.32
2004-2005						
Men	6750	155.32	110.53	151.67	17.09	23.64
Women	3035	76.95	54.40	66.41	7.34	16.13
Total	9785	118.03	84.23	108.85	12.27	20.66

[a]Adjusted to 1982 census population of China; [b]Adjusted to World's population in 1960

incidences of some cancers such as liver cancer, gastric cancer, esophageal cancer, and nasopharyngeal cancer, and identified 20 high-incidence regions for major cancers in China, including two in Guangxi (a high-incidence region for liver cancer in Fusui county and a high-incidence region for nasopharyngeal cancer in Cangwu county) (Dong et al., 2009). These findings suggest that cancer is one of the major diseases that pose threat to the health of residents in Guangxi. This study sought to describe the distribution features and developmental trends of cancers in Guangxi by analyzing data from the three surveys.

Guangxi Zhuang Autonomous Region

Guangxi Zhuang Autonomous Region is located in southwestern China and has a total population of about 51.59 million in 2010, which is mainly composed of ethnic Han and Zhuang, accounting for 62% and 34% of the total population in Guangxi, respectively. Nanning, the capital of Guangxi, is located in the southwest of the region. Other major administrative areas include 13 prefecture-level cities. The geographical location and administrative divisions of Guangxi are shown in Figure 1.

Materials and Methods

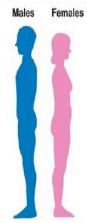
Causes of death surveys

Data on cancer deaths derive from three surveys on causes of death. The 1971-1973 survey covered the entire Guangxi Zhuang Autonomous Region and targeted the entire population living in Guangxi, totaling 73.14 million person-years. The 1990-1992 retrospective sampling survey of causes of death in Guangxi residents stratified counties and cities according to cancer mortality before choosing 10 counties and cities from each level using random cluster sampling to create a sample pool for Guangxi, involving a total of 13.39 million person-years and accounting for 10% of the Guangxi population over the same period. The 2004-2005 retrospective sampling survey covered 9 random sample points and cancer mortality monitoring points that involved a total of 8.29 million person-years, accounting for 8.5% of Guangxi's total population over the same period.

Table 2. The Constituent Ratios (%) and Mortality Rates (1/100,000) of the Top Ten Cancers in the Three Cause-of-death Surveys in Guangxi

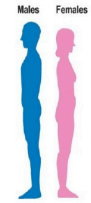
1971–1973

	death	proportion	mortality		death	proportion	mortality
Liver	8900	48.53	23.89	Liver	2315	23.87	6.45
Stomach	2388	13.02	6.41	Cervix uteri	1524	15.71	4.25
Nasopharynx	2227	12.14	5.98	Colorectum	1418	14.62	3.95
Colorectum	2042	11.13	5.48	Stomach	1257	12.96	3.50
Oesophagus	1435	7.82	3.85	Nasopharynx	975	10.05	2.72
Lung	905	4.93	2.43	Oesophagus	775	7.99	2.16
Leukaemia	425	2.32	1.14	Breast	706	7.28	1.97
Breast	19	0.10	0.05	Lung	417	4.3	1.16
—				Leukaemia	311	3.21	0.87
All cancers	18341	100.00	49.22	All cancers	9698	100.00	27.03



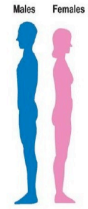
1990–1992

	death	proportion	mortality		death	proportion	mortality
Liver	2901	40.33	41.78	Liver	754	21.43	11.7
Lung	1084	15.07	15.61	Stomach	530	15.07	8.23
Stomach	1044	14.51	15.03	Lung	459	13.05	7.13
Nasopharynx	354	4.92	5.1	Leukaemia	218	6.20	3.38
Oesophagus	338	4.70	4.87	Breast	208	5.91	3.23
Leukaemia	269	3.74	3.87	Nasopharynx	185	5.26	2.87
Colorectum	252	3.50	3.63	Cervix uteri	151	4.29	2.34
Bladder	65	0.90	0.94	Colorectum	145	4.12	2.25
—				Oesophagus	137	3.89	2.13
—				Bladder	18	0.51	0.28
All cancers	7194	100.00	103.6	All cancers	3518	100.00	54.61



2004–2005

	death	proportion	mortality		death	proportion	mortality
Liver	2431	36.01	55.94	Liver	573	18.88	14.53
Lung	1463	21.67	33.66	Lung	571	18.81	14.48
Stomach	781	11.57	17.97	Stomach	365	12.03	9.25
Nasopharynx	414	6.13	9.53	Breast	245	8.07	6.21
Colorectum	316	4.68	7.27	Colorectum	191	6.29	4.84
Oesophagus	234	3.47	5.38	Nasopharynx	134	4.42	4.84
Leukaemia	171	2.53	3.93	Cervix uteri	117	3.86	2.97
Bladder	58	0.86	0.97	Oesophagus	112	3.69	2.84
Breast	2	0.03	0.05	Leukaemia	112	3.69	2.84
—				Bladder	22	0.72	0.58
All cancers	6750	100.00	155.32	All cancers	3035	100.00	76.95



Data collection

The causes of death and other relevant information in the survey sites were collected, including demographic features of the deceased (name, sex, date of birth, ethnic group, marital status, education, occupation), causes of death (direct, indirect, or underlying cause of death and other important medical information), date of death, place of death, disease diagnosis and medical facilities that made the diagnosis. Meanwhile, the size of the population and births stratified by gender and age at the end of each year in the region over the same period were also collected.

Statistical analysis

Using Excel 2003 and the software program DeathRegister2012 designed by us, we analyzed the sex, age and district differences between three surveys, in which the standardized mortality rate of the Chinese population was calculated using the age structure of the 1982 national census and the standardized mortality rate of the world population was calculated using the age structure of the world population in 1960.

Results

All cancers

Table 1 presents the basic information of all cancer-related deaths in the three surveys in Guangxi. As the 1970s survey in Guangxi only collected information on cancer-related death, it is impossible to know the constituent ratios of cancer deaths with respect to all-cause deaths.

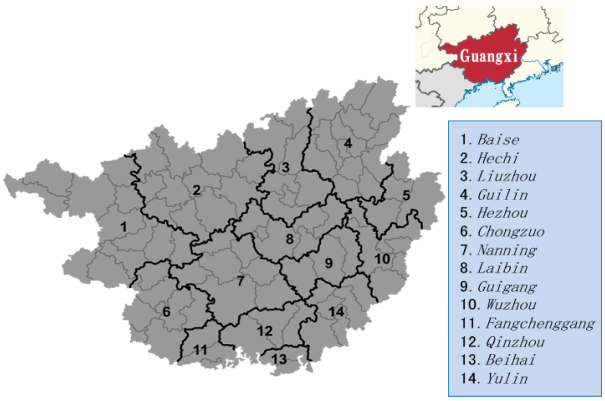


Figure 1. The Geographical Location and Administrative Divisions of Guangxi

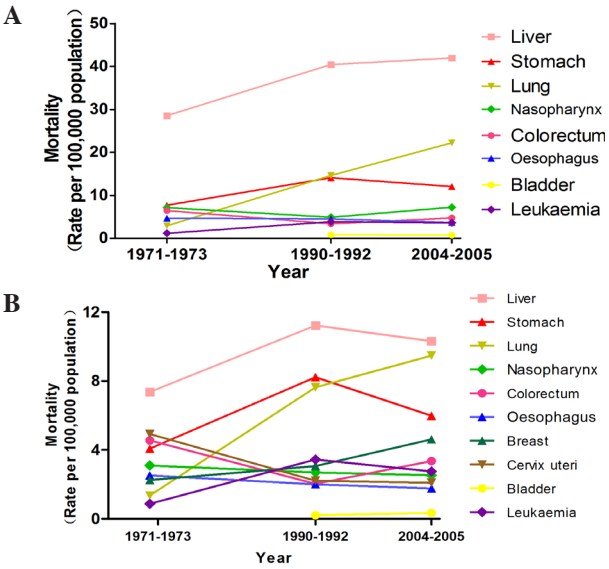


Figure 2. Time Trends in Standardized Mortality Rates (1/100,000) of Major Cancers in the Three Cause-of-death Surveys in Guangxi (A, men; B, women)

Major cancers

Table 2 shows the constituent ratios and mortality rates of the top ten cancers in the three cause-of-death surveys in Guangxi. In the 1971-1973 survey, liver cancer mortality rate was followed by gastric cancer, nasopharynx cancer, colorectal cancer and esophageal cancer in men, which were the second to fifth most common causes of cancer-related deaths. Together, the five cancers led to 92.64% of cancer-related deaths in men. The difference between the mortality rate of liver cancer and cervical cancer, colorectal cancer, gastric cancer, nasopharyngeal cancer was not as significant as that seen in men. Together, the five cancers accounted for 77.22% of cancer deaths in women. In the 1990-1992 survey, liver cancer still was the most common cause of cancer-related deaths in men and women. However, cancers that ranked second to fifth in mortality in this survey differed from those in the 1970s survey. In the 2004-2005 survey, the rank of the top five cancers mortality rate differed slightly from that of the 1990s.

Time trends in major cancer mortality

The standardized mortality rates of cancers in Guangxi residents were calculated by using the data of the 1982 census in China, and their change over time was analyzed. The results are shown in Table 3 and Figure 2. Over the past 30 years, cancers with a rising mortality rate in men in Guangxi included lung cancer, colorectal cancer and liver cancer. Lung cancer saw the most significant increase, with a steep rise of 413.68% over twenty years from the 1970s to the 1990s and a further rise of 51.78% in the early 2000s. Esophageal cancer was the only cancer with a decreasing mortality rate and also the only cancer with an overall declining mortality rate in the past 30 years. The trend in the mortality of nasopharyngeal cancer was quite unique, as its mortality declined by 30.00% in the first 20 years, but increased to the level of the 1970s in the early 2000s.

Cancers with a rising mortality rate in women in Guangxi included lung cancer, colorectal cancer and breast cancer. Lung cancer also saw the most significant increase, with a steep rise of 421.88% over twenty years from the 1970s to the 1990s and a further rise of 41.92% in the early 2000s. Cancers with a declining mortality include cervical cancer, esophageal cancer and nasopharyngeal cancer. The mortality of cervical cancer saw the steepest decline (54.94%) from the 1970s to the 1990s, but decreased very slowly in the past 10 years.

Table 3. Time Trends in Standardized Mortality Rates of Major Cancers in the Three Cause-of-death Surveys in Guangxi (1/100,000)

	First survey	Second survey	Third survey	1st vs. 2nd	2nd vs. 3rd	1st vs. 3rd
Men						
Liver cancer	28.02	40.43	41.97	44.29	3.81	49.79
Lung cancer	2.85	14.64	22.22	413.68	51.78	679.65
Gastric cancer	7.52	14.10	12.06	87.50	-14.47	60.37
Nasopharyngeal cancer	7.00	4.90	7.24	-30.00	47.76	3.43
Esophagus cancer	4.54	4.53	3.67	-0.22	-18.98	-19.16
Colorectal cancer	2.33	3.40	4.74	45.92	39.41	103.43
Leukemia	1.14	3.85	3.61	237.72	-6.23	216.67
Women						
Liver cancer	7.03	11.22	10.32	59.60	-8.02	46.80
Lung cancer	1.28	6.68	9.48	421.88	41.92	640.63
Gastric cancer	3.84	7.64	5.98	98.96	-21.73	55.73
Nasopharyngeal cancer	2.96	2.69	2.54	-9.12	-5.58	-14.19
Esophagus cancer	2.39	2.00	1.77	-16.32	-11.50	-25.94
Colorectal cancer	1.55	2.04	3.36	31.61	64.71	116.77
Breast cancer	2.14	3.07	4.61	43.46	50.16	115.42
Cervical cancer	4.66	2.21	2.10	-52.58	-4.98	-54.94
Leukemia	0.86	3.44	2.75	300.00	-20.06	219.77

Gender and age distribution of major cancers

Table 4 shows the age distribution of major cancers in Guangxi. In the 1970s, cancer-related deaths in male residents in Guangxi were mainly concentrated in the 45-64 years age group (48.41%), followed by the 15-44 years age group (36.32%). In the 1990s, cancer-related deaths in male residents in Guangxi still occurred most frequently in the 45-64 years age group (44.30%), followed by the over-65 age group (30.90%), which replaced the 15-44 years age group at second place. In the early 2000s, of the male population who died of cancer in Guangxi, the share of the over-65 age group rose to 43.33% and ranked first, whereas the 45-64 years age group dropped to second place with a share of 39.27%. Similarly, for some of the

Table 4. Constituent Ratio of Age Distribution of Major Cancers in Guangxi over the Past 30 Years

	0-4 years		5-14 years		15-44 years		45-64 years		over 65 years		Total	
	male	female	male	female	male	female	male	female	male	female	male	female
1971-1973												
Nasopharyngeal	0.04	0.00	0.49	0.82	36.87	38.56	53.08	48.00	9.52	12.62	100.00	100.00
Esophagus	0.00	0.00	0.00	0.00	8.99	10.97	58.95	56.52	32.06	32.52	100.00	100.00
Gastric cancer	0.00	0.00	0.00	0.00	16.08	16.95	63.61	56.17	20.31	26.89	100.00	100.00
Liver cancer	0.13	0.35	0.58	1.12	48.88	38.44	43.56	48.25	6.84	11.84	100.00	100.00
Rectal cancer	0.00	0.00	0.14	0.00	24.45	25.10	48.36	50.20	27.05	24.70	100.00	100.00
Lung cancer	0.00	0.00	0.00	0.24	20.66	23.02	59.34	55.40	20.00	21.34	100.00	100.00
Breast cancer	—	0.00	—	0.14	—	24.93	—	52.97	—	21.95	—	100.00
Cervical cancer	—	0.00	—	0.00	—	18.90	—	60.24	—	20.87	—	100.00
Leukemia	18.59	18.33	25.41	19.61	42.82	44.69	12.00	14.47	1.18	2.89	100.00	100.00
Intestinal cancer	3.82	3.17	6.64	5.46	32.44	32.31	38.40	41.27	18.70	17.79	100.00	100.00
All cancers	0.77	0.97	1.41	1.52	36.32	27.69	48.41	50.80	13.09	19.02	100.00	100.00
1990-1992												
Nasopharyngeal	0.00	0.00	0.00	0.00	24.86	28.65	52.82	41.62	22.32	29.73	100.00	100.00
Esophagus	0.00	0.00	0.00	0.00	10.06	5.11	41.72	46.72	48.22	48.18	100.00	100.00
Gastric cancer	0.00	0.00	0.00	0.00	10.34	10.38	44.73	39.25	44.92	50.38	100.00	100.00
Colorectal cancer	0.00	0.00	0.40	0.69	13.89	15.17	48.02	39.31	37.70	44.83	100.00	100.00
Liver cancer	0.21	0.13	0.41	0.40	33.57	25.33	45.43	44.83	20.37	29.31	100.00	100.00
Lung cancer	0.00	0.00	0.09	0.00	9.32	12.85	46.96	42.70	43.63	44.44	100.00	100.00
Breast cancer	—	0.00	—	0.00	—	27.40	—	49.04	—	23.56	—	100.00
Cervical cancer	—	0.00	—	0.00	—	17.88	—	43.71	—	38.41	—	100.00
Bladder cancer	0.00	0.00	0.00	0.00	9.23	5.56	36.92	11.11	53.85	83.33	100.00	100.00
Leukemia	11.15	15.14	14.13	15.60	45.35	42.20	21.19	21.10	8.18	5.96	100.00	100.00
All cancers	0.75	1.28	1.10	1.71	22.95	20.78	44.30	39.91	30.90	36.33	100.00	100.00
2004-2005												
Nasopharyngeal	0.00	0.00	0.24	0.00	22.46	29.10	49.52	37.31	27.78	33.58	100.00	100.00
Esophagus	0.00	0.00	0.00	0.00	7.26	1.79	39.74	20.54	52.99	77.68	100.00	100.00
Gastric cancer	0.00	0.00	0.13	0.00	8.83	8.77	35.08	27.40	55.95	63.84	100.00	100.00
Colorectal cancer	0.00	0.52	0.00	0.00	9.18	7.85	32.91	30.89	57.91	60.73	100.00	100.00
Liver cancer	0.08	0.00	0.21	0.00	24.97	18.32	45.13	38.39	29.62	43.28	100.00	100.00
Lung cancer	0.00	0.00	0.00	0.00	7.31	8.23	34.24	27.15	58.44	64.62	100.00	100.00
Breast cancer	—	0.00	—	0.00	—	26.94	—	50.61	—	22.45	—	100.00
Cervical cancer	—	0.00	—	0.00	—	18.80	—	43.59	—	37.61	—	100.00
Bladder cancer	0.00	0.00	0.00	0.00	5.17	0.00	20.69	18.18	74.14	81.82	100.00	100.00
Leukemia	7.60	4.46	4.68	8.93	43.27	39.29	25.73	24.11	18.71	23.21	100.00	100.00
All cancers	0.28	0.49	0.41	0.49	16.70	15.82	39.27	33.71	43.33	49.49	100.00	100.00

major cancers that caused death in the male population in Guangxi such as liver cancer, lung cancer, gastric cancer and nasopharyngeal cancer, the age at death shifted to a later age. Leukemia, which occurs more often in teenagers, saw a shift in age of death to a later age over the past 30 years, but it still peaked in the 15-44 years age group.

Over the past 30 years, the age of cancer-related death in the female population in Guangxi also tended to shift to a later age, as seen in men. However, the death of female breast cancer tended to shift to an earlier age. While breast cancer-related deaths occurred most frequently in the 45-64 years age group, the share of the 15-44 years age group who died of breast cancer has grown from 24.93% in the 1970s to 27.40% in the 1990s and 26.94% in the early 2000s, while the share of over-65 years age group changed little in the same period.

Geographical distribution of major cancer mortality

The geographic distribution of major cancer mortality in the 14 municipalities of Guangxi is shown in Figure 3. Data on all cancer deaths in the 1970s survey showed that the area with the highest mortality (51.92/100,000) was located in Laibin, the geographical center of Guangxi. Nanning, Fangchenggang, Qinzhou, Beihai and Chongzuo, which are located to the southwest of Laibin, were associated with high cancer mortality rates (> 46/100,000). Hechi, located to the northwest of Laibin, had comparable cancer mortality rates (between 40/100,000 and 46/100,000) with those of Guigang, Wuzhou, and Hezhou, which are located to the southeast of Laibin. Other cities including Guilin, Yulin, Liuzhou, and Baise were associated with low cancer mortality rates (all below 40/100,000). The distribution of some of the major cancers in Guangxi also had their own characteristics. For example, liver cancer mortality was very high in Chongzuo at 30.18/100,000, 3.5 times as high as that of Liuzhou (8.57/100,000). The mortality rate of lung cancer was very low in Guangxi (all below 4/100,000). The mortality rate of nasopharyngeal carcinoma was the highest in Wuzhou at 8.39/100,000, 3.7 times as high as that of Hechi (2.28/100,000).

Since the 1990-1992 survey and the 2004-2005 survey did not cover the whole of Guangxi, we could only collect cancer mortality data from some sample points in the 14 administrative regions. Nevertheless, the data still offer a glimpse of the geographical features of cancer-related

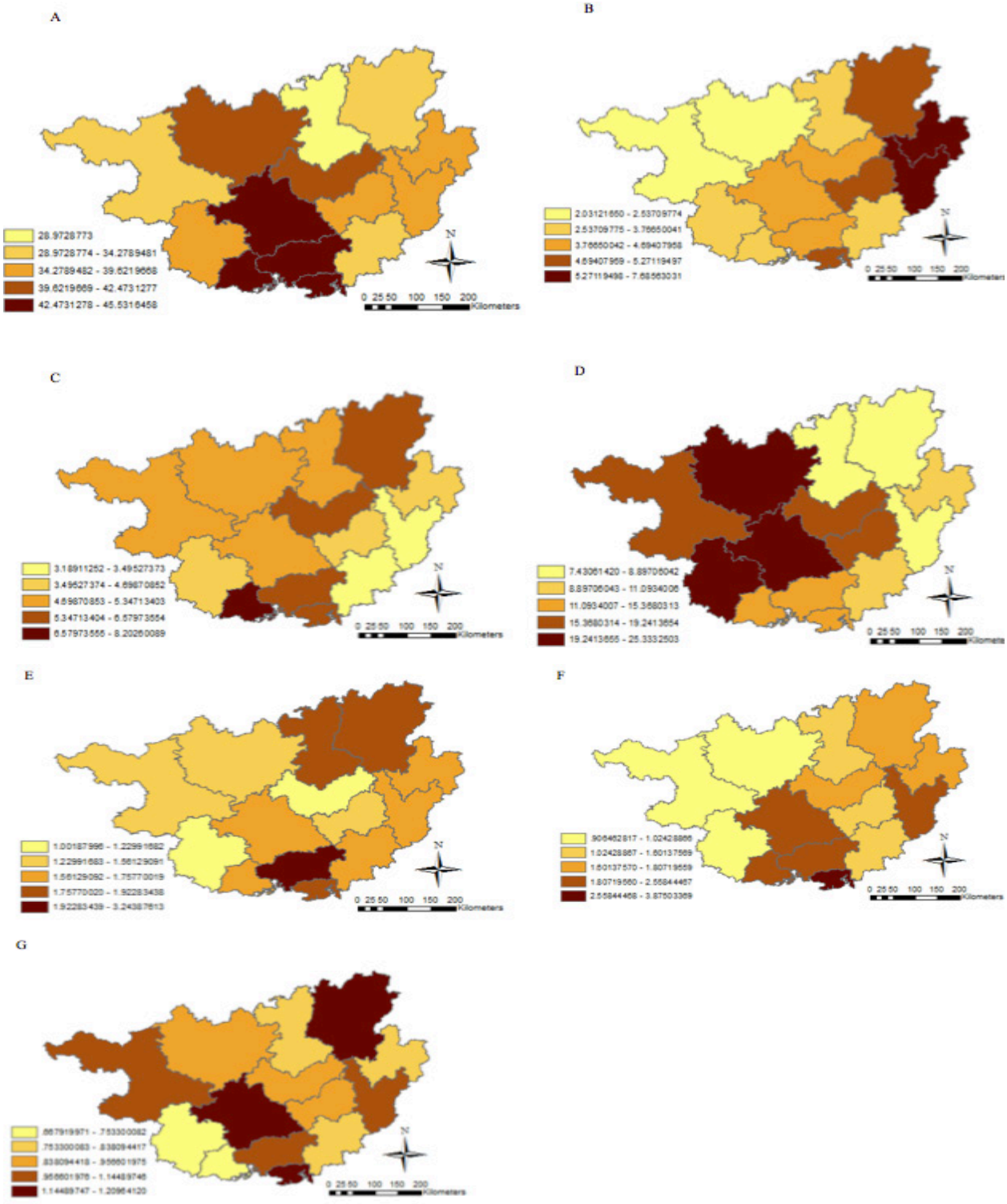


Figure 3. Geographical Distribution of Major Cancer Mortality Rates (1/100,000) in Guangxi in 1971-1973 (A, all cancers; B, nasopharyngeal cancer; C, gastric cancer; D, liver cancer; E, colorectal cancer; F, lung cancer; G, breast cancer)

deaths in Guangxi. For instance, Chongzuo and Wuzhou remained the areas with the highest mortality rates in liver cancer and nasopharyngeal cancer, respectively. The mortality rate of lung cancer showed an upward trend in all regions, with the most significant rises seen in urban areas, including Beihai, Guilin and Nanning.

Discussion

Data on cancer-related deaths in Guangxi from three surveys show that cancer has always been one of the leading causes of death in the population of Guangxi. The severity of cancer was especially high in the early 2000s, when cancer mortality rates reached 118.03/100,000 in Guangxi, and cancer accounted for 20.66% of total deaths and became the second most-prevalent cause of death, second only to circulatory system diseases. In other words, one out of every five people died of cancer. In terms of cancer distribution in the population, men had a higher cancer mortality rate than women, with a male-to-female

mortality rate of 2.02:1. This may be related to higher exposure to cancer risk factors in everyday life, higher social pressure, and more common unhealthy living habits like smoking and drinking in men.

In terms of the structure of causes of cancer-related death, the five most prevalent cancers, including liver cancer, accounted for over 60% of all cancer-related deaths and were the major cancers that caused death in the population in Guangxi. Liver cancer ranked first in mortality rate in the ten most prevalent cancers across the three surveys. According to the global standardized cancer mortality rates of some countries in 2002 released by the International Agency for Research on Cancer (IARC), the global standardized cancer mortality rates of all cancers in Guangxi in the early 2000s were lower than the world average (137.7/100,000) and developed countries (169.6/100,000) and comparable to the level of developing countries (119.2/100,000) (Ferlay et al., 2007). However, the mortality rates of some major cancers in Guangxi were among the highest worldwide. For example, the standardized mortality rate of liver cancer in the male population in Guangxi was 1.57 times, 3.64 times, 3.21 times and 6.79 times the average rate in China, the world, developing countries, and developed countries, respectively. The standardized mortality rate of nasopharyngeal cancer in the male population in Guangxi was 2.24 times and 1.71 times the average rate in China and Singapore, respectively, and 15 to 45 times that in European countries and the United States, Japan, and Thailand. Therefore, the top five cancers, especially liver cancer and nasopharyngeal cancer, should be the focus of research, prevention and control, and clinical efforts in Guangxi.

Look into the time trends of cancer mortality in Guangxi, the rise ranked among the highest nationwide (Zhao P et al., 2010). It may be related to population aging (Dong ZW, 2002), more treatment opportunities for cancer patients thanks to significantly improved health conditions and techniques, and markedly reduced misdiagnosis and missed diagnosis. Of the major cancers in Guangxi, the mortality rate of lung cancer saw the largest increase in China. While lung cancer mortality increased by 1 to 2 times in most Chinese provinces in the past 30 years (Zhao et al., 2010), it rose by as much as 7.02 times in Guangxi during the same period. Studies have shown that smoking is a major risk factor for lung cancer and is closely related to environmental pollution as a result of industrial wastes and traffic emissions (Yao et al., 2003; de Groot et al., 2012). Indoor micro-environmental pollution may be another risk factor for lung cancer (Spitz et al., 2006; Thun et al., 2008). Accordingly, these risk factors for lung cancer can be targeted in primary prevention (Centers for Disease Control and Prevention, 2007; Organization, 2010). Though the rise in liver cancer mortality rate was not as significant as that of lung cancer, it continues to rise. In addition, liver cancer represents the biggest culprit causing cancer-related deaths. The incidence of liver cancer has continued to decrease over the last decade in Korea and Japan demonstrated that the government combined effective vaccination efforts with a successful national cancer screening system, creating a model for basing public health policy and law on scientific and epidemiologic evidence (Gwack et al., 2011; Okamoto, 2013; Yeo et al., 2013). Considerating the high contribution of HBV, aflatoxin and other risk factors to liver cancer in China (Fan et al., 2013), we should endeavor to introduce the Hepatitis B vaccine into national infant immunization schedules (Organization, 2009; Chang, 2014), reduce aflatoxin B contamination through crop substitution and improved grain storage practices (Ming et al., 2002; Turner et al., 2005), and purify drinking water (Zhu, 2012). Though at relatively low levels nationwide, the mortality rates of colorectal cancer and female breast cancer have been increasing over the past 30 years in Guangxi, and these two cancers have been a growing threat to local residents and women, given their long-term upward trend. Such unfavorable trends in colorectal cancer are thought to reflect a combination of factors including changes in dietary patterns, obesity, physical inactivity, excessive alcohol consumption and an increased prevalence of smoking (García-Álvarez et al., 2007; Ferrari et al., 2007; Center et al., 2009). The increasing mortality rate of female breast cancer largely stems from reproductive and hormonal factors, unhealthy lifestyle and obesity also increase the risk of breast cancer (Colditz et al., 2005; Hulka et al, 2008). Maintaining a healthy body weight, increasing physical activity, and minimizing alcohol intake are the best available strategies to reduce the risk of developing breast cancer (Kushi et al., 2006). Cervical cancer mortality has been declining in female residents in Guangxi, but at a slower pace, which merits the attention of relevant researchers. Population-based screening programs can reduce the risk of developing advanced cervical cancer and associated deaths (Sankaranarayanan et al., 2009; Sherris et al., 2009). This approach is also feasible for the second prevention of colorectal cancer and female breast cancer (Mandel et al., 1993; Anderson et al., 2008; Zauber et al., 2008; Atkin et al., 2010), but all the screening programs should be proposed according to local economic and social conditions, and evaluated by cost-effectiveness analysis (Cho et al., 2013; Ito et al., 2013).

The cause of death survey in the 1970s characterized for the first time the geographical distribution of cancers in Guangxi and identified a high-incidence region for liver cancer in Fusui and a high-incidence region for nasopharyngeal cancer in Cangwu. In the past 30 years, the government and research institutions have been implementing cancer prevention programs in these two regions. The incidence and death of cancer were monitored continuously; the risk factors implicated in liver cancer were detected and examined; long-term and comprehensive prevention was performed in Fusui. In 2006, effort was made to initiate early detection and treatment of liver cancer in high-incidence regions. Subsequently, the screening for esophagus cancer, nasopharyngeal cancer, female breast cancer, and cervical cancer was launched in selected areas in Guangxi. The successful efforts in building Fusui into a demonstration base for early detection and treatment of liver cancer shows that the combination of water improvement, hepatitis B vaccination, and prevention of mold growth

in food will help reduce the incidence of liver cancer in high-risk areas. In light of the geographical distribution of cancers, Guangxi is now promoting early detection and treatment programs for liver cancer and nasopharyngeal cancer in 20 high-risk cities and counties and is taking this opportunity to make prevention and control planning for major cancers in different areas of Guangxi. At the same time, we hope the population based cancer registration could be gradually implemented in all counties to provide an essential base for cancer control, providing information not only on incidence and survival but also facilitating confirmation of effective of interventions, including screening in the future (Moore MA, 2013).

As shown by the gender and age distribution of cancers in Guangxi, cancer-related deaths occurred mainly in the elderly population. This susceptibility may be related to functional decline and long-term cumulative exposure to carcinogenic factors in the elderly population. Accordingly, future cancer prevention and control efforts in Guangxi should focus on the elderly population, especially the middle-aged male population; targeted intervention and control measures should be taken in light of the different rates of cancer incidence between genders. In secondary prevention of cancer, the target population can be chosen in accordance with the age and sex distribution of cancers to improve the cost-effectiveness of screenings (Cucchetti et al., 2013).

In summary, cancer mortality rates have been continuing to increase in Guangxi over the past three decades. Therefore, it is recommended that Guangxi should continue to implement primary prevention measures to eliminate risk factors for cancer and reduce the risk of cancer; provide health education and professional training on early signs of cancer; promote healthy lifestyles; launch extensive prevention efforts for early detection, early diagnosis and early treatment; and offer effective, standardized and reasonable diagnosis and treatment, all of which are critical to achieve the ultimate goal of lowering cancer mortality in Guangxi.

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