Letter to the Editor
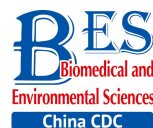
Estimation Study of New Cancer Cases and Deaths in Wuwei, Hexi Corridor Region, China, 2018[*]

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Population-based cancer registration data were collected to estimate the cancer incidence and mortality in Wuwei, Hexi Corridor Region, China in 2018. We used the 2011-2013 data to predict the number of new cases and deaths in 2018 and the 2003-2013 data to analyze trends in cancer incidence and mortality. The goal is to enable cancer prevention and control directions. Our results indicated that stomach cancer is the most common cancer. For all cancers combined, the incidence and mortality rates showed significantly increasing trends (+2.63% per year; *P* < 0.05 and +1.9% per year; *P* < 0.05). This study revealed a significant cancer burden among the population of this area. Cancer screening and prevention should be performed after an epidemiological study of the cause of the cancer is completed.

Cancer is a leading cause of death in developed countries. As a result of population growth and aging, the global burden of cancer is expected to increase, especially in developing countries[1]. Cancer is also a major public health problem and became the leading cause of death in 2010 in China[2]. Wuwei, a city in Gansu province located in the Hexi Corridor area, the eastern gate of the silk road, is a location in China where the incidence of upper gastrointestinal tract cancer, especially gastric cancer, is very high[3].

The causes of malignant tumors have not yet been fully elucidated. According to previous epidemiological studies and experimental and clinical observations, the environment and human behaviors have important effects on the occurrence of malignant tumors. It has been estimated that nearly 60% of cancer deaths can be avoided[4].

The aim of this study was to estimate new cancer cases and deaths in 2018 and analyze the trends in cancer incidence and mortality (2003-2013)

to provide scientific evidence. Elucidating such information will allow us to predict new possible cancer cases in the future and provide a guideline to prevent and control its development in this area.

The Wuwei Cancer Registry is hosted by Wuwei Tumor Hospital. The registry has been used to track cancer incidence and mortality of local residents of this region for > 10 years. The Wuwei Cancer Registry includes data for more than 1 million people, which covers about 60% of the population of Wuwei city and approximately 28% of the Hexi Corridor area[3]. The information includes cancer incidence, survival, related deaths, and population demographics. Moreover, the Wuwei Cancer Registry is used for technical guidance, professional training, registration, coding, collation, analysis, and data dissemination in this region.

To create the Wuwei Cancer Registry, first, cancer data were collected from the local population using the International Classification of Diseases (ICD)-10 codes of C00-C97. Then, the data were submitted to the National Central Cancer Registry of China (NCCR). The quality of the submitted data was checked and evaluated by the NCCR based on the Guidelines for Chinese Cancer Registration[5] and International Agency for Research on Cancer/International Association of Cancer Registries (IARC/IACR) data-quality criteria. The assessments of quality measures included the proportion of the percentage of cancer cases identified *via* death certification only (DCO%), the mortality (M) to incidence (I) ratio (M/I), morphologic verification (MV%), the percentage of cancers with an undefined or unknown primary site, and the percentage of uncertified cancer.

All low-level of cancer registration points in Wuwei City made use of the 'Gansu Province Cancer

Registration Report Manual' to collect new tumor cases and death information submitted to the Wuwei Cancer Registry. Tumor registry staff checked the cancer diagnosis report card in all levels of the hospital and examined the incidence of cancer, death card reported by the village and town, removed duplicates, added missing data, modified the onset time, and feeding back suspicions to the town staff to ensure no omissions. After the audit was qualified and removed, the ICD-10 diagnoses were encoded and entered into CanRge4 software. The information was reported to the NCCR after examination by the Wuwei Cancer Registry. After the final NCCR review, the information was fed back into the Wuwei Cancer Registry. The data were used by the International Cancer Center to publish national cancer registration reports. The data (2011-2013) used in this study are national feedback data. The three main measures (MV%, DCO%, and M/I ratio) were used to evaluate the comprehension, validity, and reliability of the cancer statistics according to the IACR and NCCR requirements of cancer registration data. The outcomes were as follows: 78.59% MV%, 1.22% DCO%, and 0.71 M/I.

We used the population data from the start of 2017 to estimate the Wuwei population in 2018. The population data were collected from Wuwei City Public Security Bureaus or from calculations based on local census data.

We used 2011-2013 data to estimate the number of new cases for the top 10 individual cancer types by sex in Wuwei in 2018. We estimated the numbers of cancer deaths in Wuwei in 2018 using the same method. We used the 2003-2013 data for the analysis of cancer incidence and mortality trends. The calculation of cancer incidence using the ICD-10 classification for consistency and analysis of mortality data involves the same method. The variables were sex, age, date of birth, year of diagnosis, and cancer site.

We used MS Excel 2016 (Microsoft Corporation, USA), SAS 9.2 (SAS Institute Inc, USA), and CanReg4 (IARC, France) to evaluate new case and death data[6]. Age-standardized rates were also calculated according to the 2,000 Chinese population and Segi's world population.

Temporal trends in incidence and mortality rates from 2003 to 2013 were examined by fitting joinpoint models using the Joinpoint Regression Program 4.4.0.0-January to the log-transformed data. To reduce false changes, the point of the model was restricted to a maximum of two joinpoints (three line segments). We used the annual percentage change (APC) to indicate the trend and the Z test to assess whether the APC was statistically different from zero. Increases and decreases were used to describe trends when the slope (APC) of the trend was statistically significant ($P < 0.05$). For trends without statistical significance, stability could be used to describe it. Finally, based on the above analyses, we present the results for all cancers combined and stratify the data by the five most common cancers.

In incidence, stomach cancer was the most common cancer in Wuwei, followed by esophageal cancer, lung cancer, colorectal cancer, and liver cancer, with an estimated 2,100, 897, 467, 416, and 365 new cases, respectively. Stomach cancer was the most frequently diagnosed cancer in males, followed by esophageal cancer, liver cancer, lung cancer, and colorectal cancer. Stomach cancer was also the most common cancer in females, followed by breast cancer, cervix uteri cancer, esophageal cancer, and colorectal cancer (Table 1).

In mortality, stomach cancer was the leading cause of death in Wuwei, followed by esophageal cancer, lung cancer, colorectal cancer, and liver cancer, with estimated deaths of 1,222, 701, 384, 325, and 214, respectively. In males, stomach cancer was the leading cause of death, followed by esophageal cancer, lung cancer, liver cancer, and colorectal cancer; in females, stomach cancer was still the leading cause, followed by esophageal cancer, breast cancer, lung cancer, and liver cancer, breast cancer, and liver cancer. The most common sites of cancer were the stomach, lung, liver, and colorectal area in males and breast, lung, colorectal area, esophagus, and stomach in females (Table 2).

For all cancers combined, the incidence rates showed significant upward trends during the study period (2003-2013) observed, while the mortality rates also increased significantly ($P < 0.05$). Among the five most common cancers considered in the temporal trend analyses, incidences for 2003-2013 increased for two cancer types (liver and colorectal; $P < 0.05$). Stable trends were observed for three cancer types (stomach, esophageal, and lung). An upward trend in mortality rates was observed for two of the five most common cancers (colorectal and esophagus; $P < 0.05$), whereas stable trends were seen for the other cancer types (lung, stomach, and liver) (Table 3).

Wuwei is an area in China with a high incidence of upper gastrointestinal tract cancer, especially gastric cancer[3]. Cancer prevention and control is based on

Table 1. Estimated Top 10 New Cancer Cases in 2018*

Rank	Both					Male					Female				
	Site	New cases	Incidence (1/10^5)	Proportion %	ASR-C (1/10^5)	Site	New cases	Incidence (1/10^5)	Proportion %	ASR-C (1/10^5)	Site	New cases	Incidence (1/10^5)	Proportion %	ASR-C (1/10^5)
1	Stomach	2,100	109.28	34.63	88.43	Stomach	1,544	154.63	42.79	128.96	Stomach	557	60.30	22.66	47.46
2	Esophagus	897	46.67	14.79	39.04	Esophagus	676	67.72	18.74	57.99	Breast	358	38.82	14.59	30.80
3	Lung	467	24.31	7.71	19.98	Lung	298	29.89	8.27	25.73	Cervix uteri	231	25.02	9.40	19.51
4	Colorectal	415	21.60	6.85	17.91	Liver	273	27.38	7.58	22.60	Esophagus	221	23.93	8.99	19.55
5	Liver	365	18.99	6.02	15.45	Colorectal	246	24.61	6.81	21.35	Colorectal	170	18.36	6.90	14.37
6	Breast	359	38.82	5.91	30.80	Lymphoma	67	6.67	1.85	5.67	Lung	169	18.29	6.87	14.26
7	Cervix uteri	231	25.02	3.81	19.51	Bladder	55	5.48	1.52	4.55	Ovary	98	10.61	3.99	8.86
8	Lymphoma	111	5.75	1.82	3.70	Leukemia	50	4.97	1.38	4.49	Liver	92	9.93	3.73	8.14
9	Gallbladder	107	5.56	1.76	4.57	Brain, CNS	47	4.72	1.31	3.93	Thyroid	65	7.00	2.63	5.51
10	Ovary	98	10.61	1.62	8.86	Gallbladder	42	4.22	1.17	3.74	Gallbladder	65	7.00	2.63	5.44

Note. *The total number of cases projected for 2018 are based on the mean incidence for the most recent 3 years (2011-2013) of data extracted from the Wuwei Cancer Registry; CNS, central nervous system; ASR-C, Chinese age-standardized rate.

Table 2. Estimated Top 10 Cancer Deaths in 2018*

Rank	Both					Male					Female				
	Site	Deaths	Mortality (1/10^5)	Proportion %	ASR-C (1/10^5)	Site	Deaths	Mortality (1/10^5)	Proportion %	ASR-C (1/10^5)	Site	Deaths	Mortality (1/10^5)	Proportion %	ASR-C (1/10^5)
1	Stomach	1,222	63.56	29.96	54.31	Stomach	930	93.14	36.83	81.75	Stomach	292	31.61	18.79	26.58
2	Esophagus	701	36.47	17.19	31.54	Esophagus	515	51.60	20.41	46.07	Esophagus	186	20.12	11.96	16.89
3	Lung	384	20.00	9.43	17.14	Lung	246	24.61	9.73	21.72	Breast	183	19.78	11.76	17.36
4	Liver	325	16.90	7.96	14.17	Liver	232	23.22	9.18	19.79	Lung	139	15.02	8.93	12.60
5	Colorectal	214	11.11	5.24	9.73	Colorectal	126	12.65	5.00	11.50	Liver	93	10.06	5.98	8.54
6	Breast	183	19.78	4.48	17.36	Lymphoma	70	6.99	2.76	6.25	Colorectal	87	9.45	5.62	7.86
7	Lymphoma	127	6.60	3.11	5.79	Leukemia	46	4.59	1.82	4.60	Cervix uteri	82	8.91	5.29	7.97
8	Gallbladder	115	5.98	2.82	4.94	Brain, CNS	40	3.96	1.57	3.61	Gallbladder	78	8.50	5.05	6.74
9	Leukemia	86	4.48	2.11	4.58	Gallbladder	36	3.65	1.44	3.21	Lymphoma	57	6.19	3.68	5.33
10	Cervix uteri	82	8.91	2.02	7.97	Bladder	31	3.08	1.22	2.74	Ovary	51	5.57	3.31	5.22

Note. *The total number of cases projected for 2018 are based on the mean incidence for the most recent 3 years (2011-2013) of data from Wuwei Cancer Registry; CNS, central nervous system; ASR-C, Chinese age-standardized rate.

Table 3. Trends in Cancer Incidence and Mortality Rates for Selected Cancers and
All Cancers Combined by Sex in Wuwei, 2003-2013

Site	ICD-10	Incidence		Mortality	
		Years	APC	Years	APC
All	All sites	2003-2013	2.63[*]	2003-2013	1.90[*]
Stomach	C16	2003-2013	0.15	2003-2013	0.72
Esophagus	C15	2003-2013	-1.09	2003-2013	6.94[*]
Lung	C33-C34	2003-2013	1.91	2003-2013	6.48
Colorectal	C18-C21	2003-2013	6.22[*]	2003-2013	6.92[*]
Liver	C22	2003-2013	4[*]	2003-2013	-1.76

Note. ICD-10, International Classification of Diseases, 10th revision; APC, annual percentage change. [*]The APC is significantly different from zero ($P < 0.05$).

obtaining population malignancy incidence and death data to enable examination of the social burden caused by the cancer and intervention in the impact of malignant tumors. The analysis of the incidence and timing of cancer in this study is critical to the tertiary prevention of cancer. The Wuwei Cancer Registry covers a population base of 100 million people, equivalent to approximately 28% of the Hexi Corridor[7], and the registry data are the best cancer data in the area.

In our estimation of the cancer incidence and deaths in this area, the top 10 cancer types differ from those in Gansu province in 2012[8]. The most common types of cancer were gastric and esophageal, irrespective of sex. This finding was consistent consistent with the characteristics of cancer in Wuwei City. The standardized incidence of gastric cancer in Wuwei was much higher than that of China overall[3]. We believe that the high incidence of gastric cancer in this area is related to the local residents' lifestyle and environmental factors. First, Wuwei is located in an underdeveloped area of western China and its natural environment is relatively arid. The consumption of fresh vegetables and fruit in local people is not high, hence local people prefer high-salt and pickled foods. The local residents' scientific and cultural education levels are also relatively low, which indicates that they may not understand some of the common protective factors of gastric cancer, and the healthy living habits may not be easily accepted. The high intake of alcohol in northwest China is also a very important risk factor for gastric cancer[9].

Here we present trends in cancer death and morbidity in the Wuwei area from 2003 to 2013, and using fitting joinpoint models assessed them over time[10]. Our results showed that cancer incidence

and mortality rates increased from 2003 to 2013. We observed that the incidence of colorectal cancer increased. An epidemiological survey showed that the increased intake of baked and pickled foods as well as meat can lead to colorectal cancer[3]. According to the joinpoint analysis, this may be a long-term challenge in the Wuwei area. The effect on breast cancer in particular should be further investigated.

In this study, we estimated the most common cancer cases and deaths in 2018 and used joinpoint models to describe the trends in cancer incidence and mortality from 2003 to 2013. The results of this study will aid in the development of cancer prevention programs. The present study demonstrates the first application of such method in cancer research in the Hexi Corridor region. However, our study has limitations, such as the registry does not yet fully cover the entire population in this region; thus, we estimate that biases may exist and that, the actual situation may be more severe.

The current state of tumor prevention and control is very serious. Thus, the following steps are warranted: first, we should conduct epidemiological studies to identify the causes of high incidence of cancer based on environmental factors in the population of the region. Second, we should perform cancer screening to enable the early detection and treatment of cancer treatment among locals to reduce the social and familial losses caused by cancer.

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