Original Article

Comparison of cancer incidence and mortality between China and the United States

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Background: To summarize and compare the difference in cancer incidence and mortality between China and the United States (US).

Methods: Incidence and mortality data were extracted from the GLOBOCAN2020. US data were obtained from the American Cancer Society, while China's data were obtained from 92 cancer registries in rural and urban settings. Age-standardized incidence or mortality rates were presented based on the World Standard Population which was proposed by Segi (1960). Incidence rate ratio and mortality rate ratio were calculated to compare the difference between the two countries.

Results: In 2020, there are 4.6 and 2.3 million new cases in China and the US, respectively. The age-standardized incidence rates of all cancers in China and the US are 174.0 per 100,000 and 318.0 per 100,000, respectively. The incidence rate ratio of all cancer China to the US is 0.57, while the mortality rate ratio is 1.50. The age-standardized incidence rates of melanoma, prostate cancer, and Hodgkin's lymphoma in the US are 46.1, 7.1, and 5.4 times greater than in China, respectively. While the age-standardized incidence rates of nasopharynx cancer, esophagus cancer, and stomach cancer in China are 7.5, 4.9 and 4.9 times that of the US, respectively. The age-standardized mortality rates of nasopharynx cancer, oesophagus cancer and stomach cancer are 10.0, 5.3, and 9.4 times that of the US, respectively. The age-standardized mortality rates of oropharynx cancer, testis cancer, corpus uteri cancer, vulva cancer, mesothelioma, multiple myeloma, and melanoma of skin in the US are 2.5 to 6.1 times greater than in China.

Conclusions: There are big differences in the cancer spectrum between the two countries. Factors of economy, environment, diet, and living habits are the possible reasons for such differences. While facing increasing tumor burden challenge, improving residents' awareness of risk factors, recognizing genetic risk, and strengthening early screening are feasible options to be implemented.

Keywords: Cancer burden; prevention and control; cancer statistics; China; United States (US)

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Introduction

Improving people's health is a major issue that every country cares about and a basic condition for economic and social development. As a major public health problem worldwide, cancer is the first or second leading cause of death before the age of 70 years in more than a hundred countries (1). China issued the "Healthy China Action (2019–2030)", which included cancer prevention and control as a major

special action. As the world's largest developing and developed countries respectively, the development of China and the United States (US) have always attracted worldwide attention. Although China has achieved significant results in economic development, there is still a clear gap between China and the US in medical and health care. The incidence and mortality profiles of China are changing from those of developing countries to those of developed countries (2). Even the mortality rate of many cancers in China is higher than that in the US. Obviously, China needs to establish and refine a cancer control system at the state level to suit current socioeconomic status. There are striking geographic differences in the incidence and mortality of different cancer types in different world regions (1). This diversity reflects both the presence of local risk factors for specific cancers, and the extent to which effective cancer control measures have been implemented. The cancer mortality rate in the US continued to decline from its peak in 1991 to 2018, and the total mortality rate fell by 31%. Among them, it fell by 2.4% from 2017 to 2018, which was a record-breaking decline for the second consecutive year (3-5). Therefore, the experience and results of cancer prevention and treatment in the US are worth learning from all over the world.

Accurate population-based cancer data are the first step to planning prevention, treatment and supportive healthcare programs in countries with an increasing cancer burden. With the development and operation of population-based cancer registries (PBCR), there is a solid foundation for the estimation of national data and the comparison of data between countries.

Since China's first cancer registry was established and operated in Linzhou in 1959, China has established a total of 574 cancer registries by 2019, covering a population of 438 million (31.5% of the Chinese population). Of this population, 48% were covered by urban cancer registries and 52% by rural cancer registries. Each year, the National Central Cancer Registry, acting as the national bureau for the management of cancer registration, conducts cancer registration training programs and is responsible for the collection, management, and analysis of nationwide cancer registry data. In addition, China has also issued regulations on the management of cancer registration, providing sustainable funds to promote the continuous improvement of cancer registration in China (2). The US Cancer Statistics are the official federal cancer statistics. These statistics include cancer registry data from Centers for Disease Control and Prevention (CDC)'s National Program of Cancer Registries (NPCR) and the National Cancer Institute (NCI)'s Surveillance, Epidemiology, and End Results (SEER) Program, as well as mortality data from CDC's National Center for Health Statistics. The CDC-funded NPCR is established in 1992 and the NCI-funded SEER Program was established in 1973. Today, the NPCR supports central cancer registries in 45 states, the District of Columbia, Puerto Rico, and the US Pacific Island Jurisdictions. The data represent 96% of the US population. SEER collects and publishes cancer incidence and survival data from PBCR in 19 US geographic areas, which represent 48% of the US population (3).

In this article, we attempt to summarize and compare the difference of cancer incidence and mortality between China and the US, to provide targeted ideas for cancer prevention, screening, and control in China. We present the following article in accordance with the STROBE reporting checklist (available at https://dx.doi.org/10.21037/pcm-21-25).

Methods

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Because of the retrospective nature of the research, the requirement for informed consent was waived. The data source is the secondary analysis of routine monitoring data, so ethical approval is not required.

Data sources

According to International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10), cancer incidence and mortality data for all cancers combined (ICD-10 codes C00-C97) and for 35 cancer types: lip, oral cavity (C00-C06), salivary glands (C07-C08), oropharynx (C09-C10), nasopharynx (C11), hypopharynx (C12-C13), esophagus (C15), stomach (C16), colon (C18), rectum (C19-C20), anus (C21) (colon, rectum, and anus are combined as colorectal cancer (C18-C21)), liver (C22, including intrahepatic bile ducts), gallbladder (C23), pancreas (C25), larynx (C32), lung (C33-C34, including trachea and bronchus), melanoma of skin (C43), NMSC (C44, excluding basal cell carcinoma for incidence), mesothelioma (C45), Kaposi sarcoma (C46), female breast (C50), vulva (C51), vagina (C52), cervix uteri (C53), corpus uteri (C54), ovary (C56), penis (C60), prostate (C61), testis (C62), kidney (C64-C65, including renal pelvis), bladder (C67), brain, central nervous system (C70-C72),

thyroid (C73), Hodgkin's lymphoma (C81), non-Hodgkin's lymphoma (C82-C86, C96), multiple myeloma (C88 and C90, including immunoproliferative diseases), and leukemia (C91-C95) were extracted from the GLOBOCAN 2020, which was produced by the International Agency for Research on Cancer (IARC) (1).

Incidence data are produced by PBCR. Mortality statistics are collected and made available by the World Health organization (WHO). US data are from national sources (CDC's NPCR, NIH's SEER). China's data are from local sources (92 cancer registries in rural and urban settings). Further details of sources and quality control measures are described online at the Global Cancer Observatory (GCO) (gco.iarc.fr).

Statistical analysis

Cancer incidence is the number of new cancer cases arising in a specified period and geographic area, conveyed either as an absolute number of cases per annum or as a rate per 100,000 persons per year. Similarly, cancer mortality is the number of deaths occurring in a specified region and period, and the mortality rate is the number of deaths per 100,000 persons per year. Age-standardized incidence or mortality rates (ASR) per 100,000 person-years were presented based on the World Standard Population which was first proposed by Segi (1960) and later modified by Doll *et al.* (1966) (6). China and the US were selected for comparative analysis. Age-standardized incidence rate ratio (IRR) and mortality rate ratio (MRR) were calculated to compare the difference between the two countries. IRR = Age-standardized incidence rates $(ASIR)_{China}/ASIR_{USA}$, MRR = Age-standardized mortality rate $(ASMR)_{China}/ASMR_{USA}$.

Results

In 2020, approximately there were 19.3 million new cases for all cancers worldwide. China and the US have 4.6 and 2.3 million respectively, ranking the top two of all countries. The two together account for 35.5% of the total. The crude incidence rates in China and the US were 315.6 per 100,000 and 689.3 per 100,000, respectively. The crude incidence rate in the US was 2.18 times that of China. The ASIR of cancer in China and the US are 174.0 per 100,000 and 318.0 per 100,000, respectively. IRR China to the US is 0.57. The ASIR of melanoma, prostate cancer, Hodgkin's lymphoma, kidney cancer, and breast cancer in the US are 46.1, 7.1, 5.4, 3.76, and 2.31 times that of China, respectively. While the ASIR of nasopharynx cancer, oesophagus cancer, stomach cancer, liver cancer, gallbladder cancer and cervix uteri cancer in China are 7.5, 4.9, 4.9, 2.6, 1.8 and 1.7 times that of the US, respectively. And most of them come from the digestive system.

On the other hand, in 2020, a total of about 10 million cancer patients are expected to die globally, including about 3 million in China and about 610,000 in the US. The crude mortality rates in China and the US are 207.5 per 100,000 and 185.0 per 100,000, respectively. The ASMR of cancer in China is 129.4 per 100,000 is, which is 1.5 times higher than the US' 86.3 per 100,000. Similar to the incidence rate, the mortality rate of most malignant tumors of the digestive system in China is higher than that in the US. The ASMR of nasopharynx cancer, oesophagus cancer, stomach cancer, liver cancer, gallbladder cancer and cervix uteri cancer in China are 10.0, 5.3, 9.4, 3.7, 3.1 and 2.5 times that of the US, respectively. On the other hand, the ASMR of oropharynx cancer, melanoma of skin, corpus uteri cancer, vulva cancer, mesothelioma, multiple myeloma and testis cancer in the US are more than twice that of China. The comparison of cancer incidence and mortality between China and the US is shown in *Tables 1,2*.

There is a very significant difference in the common cancer spectrum between China and the US. The ASIR of male malignant tumors in the US is 400.9 per 100,000, which is 1.77 times higher than China's 225.4 per 100,000. Among all cancers, prostate cancer has the highest incidence rate, which is 72.0 per 100,000, while China's is 10.2 per 100,000, which is only 14.2% of the US. The top 5 tumors with ASIR for men in the US are prostate cancer, lung cancer, colorectal cancer, melanoma of skin and bladder cancer, while the top five that of Chinese men are lung cancer, gastric cancer, colorectal cancer, liver cancer and esophageal cancer. The top five cases of Chinese women are breast cancer, lung cancer, colorectal cancer, thyroid cancer and gastric cancer. In the US, breast cancer, lung cancer, colorectal cancer, corpus uteri cancer, and thyroid cancer are the top five. Although the first three malignant tumors among Chinese women and American women are the same, the ASIR of breast cancer in American women is 90.3 per 100,000, which is much higher than China's 39.1 per 100,000, and the ASIR of lung cancer and colorectal cancer are also higher than those in China.

Discussion

Cancer prevention and treatment is a project that requires

Table 1 Estimated incidence of cancer in the US and China in 2020

ICD	Cancer sites	Both							Male							Female						
		China			US			Incidence rate ratio (IRR)	China			US			Incidence rate ratio (IRR)	China			US			Incidence rate ratio (IRR)
		New cases	Crude rate [1/105]	ASIR [1/105]	New cases	Crude rate [1/105]	ASIR [1/105]		New cases	Crude rate [1/105]	ASIR [1/105]	New cases	Crude rate [1/105]	ASIR [1/105]		New cases	Crude rate [1/105]	ASIR [1/105]	New cases	Crude rate [1/105]	ASIR [1/105]	
C00-97	All cancers	4,568,754	315.60	204.80	2,281,658	689.30	362.20	0.57	2,475,945	333.70	225.40	1,226,541	748.90	400.90	0.56	2,092,809	296.70	188.20	1,055,117	631.00	333.20	0.56
C00-06	Lip, oral cavity	30,117	2.10	1.30	24,470	7.40	4.20	0.31	18,546	2.50	1.70	16,420	10.00	6.00	0.28	11,571	1.60	1.00	8,050	4.80	2.60	0.38
C07-08	Salivary glands	8,863	0.61	0.43	4,922	1.50	0.84	0.51	4,895	0.66	0.47	2,901	1.80	0.98	0.48	3,968	0.56	0.39	2,021	1.20	0.74	0.53
C09-10	Oropharynx	5,604	0.39	0.25	12,775	3.90	2.40	0.10	4,372	0.59	0.39	10,499	6.40	4.10	0.10	1,232	0.17	0.11	2,276	1.40	0.80	0.14
C11	Nasopharynx	62,444	4.30	3.00	1,898	0.57	0.40	7.50	45,331	6.10	4.30	1,360	0.83	0.59	7.29	17,113	2.40	1.70	538	0.32	0.22	7.73
C12-13	Hypopharynx	6,251	0.43	0.27	2,245	0.68	0.38	0.71	5,785	0.78	0.51	1,833	1.10	0.65	0.78	466	0.07	0.04	412	0.25	0.14	0.29
C15	Oesophagus	324,422	22.40	13.80	18,309	5.50	2.80	4.93	223,044	30.10	19.70	14,384	8.80	4.80	4.10	101,378	14.40	8.20	3,925	2.30	1.10	7.45
C16	Stomach	478,508	33.10	20.60	26,259	7.90	4.20	4.90	331,629	44.70	29.50	15,944	9.70	5.30	5.57	146,879	20.80	12.30	10,315	6.20	3.10	3.97
C18-21	Colorectum	555,477	38.40	23.90	155,008	46.80	25.60	0.93	319,486	43.10	28.60	81,654	49.90	28.70	1.00	235,991	33.50	19.50	73,354	43.90	22.90	0.85
C22	Liver	410,038	28.30	18.20	42,284	12.80	6.90	2.64	302,598	40.80	27.60	29,713	18.10	10.40	2.65	107,440	15.20	9.00	12,571	7.50	3.70	2.43
C23	Gallbladder	28,923	2.00	1.20	4,670	1.40	0.68	1.76	11,061	1.50	0.98	1,626	0.99	0.51	1.92	17,862	2.50	1.40	3,044	1.80	0.82	1.71
C25	Pancreas	124,994	8.60	5.30	56,654	17.10	8.20	0.65	70,383	9.50	6.30	29,856	18.20	9.50	0.66	54,611	7.70	4.20	26,798	16.00	7.00	0.60
C32	Larynx	29,135	2.00	1.30	12,554	3.80	2.10	0.62	25,871	3.50	2.30	9,954	6.10	3.50	0.66	3,264	0.46	0.27	2,600	1.60	0.88	0.31
C33-34	Lung	815,563	56.30	34.80	227,875	68.80	33.10	1.05	539,181	72.70	47.80	116,335	71.00	36.30	1.32	276,382	39.20	22.80	111,540	66.70	30.40	0.75
C43	Melanoma of skin	7,714	0.53	0.36	96,445	29.10	16.60	0.02	4,085	0.55	0.38	56,963	34.80	19.20	0.02	3,629	0.51	0.33	39,482	23.60	14.60	0.02
C45	Mesothelioma	3,201	0.22	0.14	3,409	1.00	0.45	0.31	1,793	0.24	0.16	2,523	1.50	0.71	0.23	1,408	0.20	0.12	886	0.53	0.24	0.50
C46	Kaposi sarcoma	269	0.02	0.01	1,078	0.33	0.25	0.04	146	0.02	0.02	957	0.58	0.46	0.04	123	0.02	0.01	121	0.07	0.03	0.33
C50	Breast	416,371	59.00	39.10	253,465	151.60	90.30	0.43	–	–	–	–	–	–	–	416,371	59.00	39.10	253,465	151.60	90.30	0.43
C51	Vulva	3,323	0.47	0.29	6,112	3.70	1.90	0.15	–	–	–	–	–	–	–	3,323	0.47	0.29	6,112	3.70	1.90	0.15
C52	Vagina	1,640	0.23	0.16	1,446	0.86	0.44	0.36	–	–	–	–	–	–	–	1,640	0.23	0.16	1,446	0.86	0.44	0.36
C53	Cervix uteri	109,741	15.60	10.70	13,545	8.10	6.20	1.73	–	–	–	–	–	–	–	109,741	15.60	10.70	13,545	8.10	6.20	1.73
C54	Corpus uteri	81,964	11.60	7.60	61,738	36.90	21.40	0.36	–	–	–	–	–	–	–	81,964	11.60	7.60	61,738	36.90	21.40	0.36
C56	Ovary	55,342	7.80	5.30	23,820	14.20	8.10	0.65	–	–	–	–	–	–	–	55,342	7.80	5.30	23,820	14.20	8.10	0.65
C60	Penis	4,628	0.62	0.42	1,515	0.92	0.50	0.84	4,628	0.62	0.42	1,515	0.92	0.50	0.84	–	–	–	–	–	–	–
C61	Prostate	115,426	15.60	10.20	209,512	127.90	72.00	0.14	115,426	15.60	10.20	209,512	127.90	72.00	0.14	–	–	–	–	–	–	–
C62	Testis	4,502	0.61	0.58	9,407	5.70	5.60	0.10	4,502	0.61	0.58	9,407	5.70	5.60	0.10	–	–	–	–	–	–	–
C64-65	Kidney	73,587	5.10	3.30	69,569	21.00	12.40	0.27	47,702	6.40	4.40	43,757	26.70	16.40	0.27	25,885	3.70	2.30	25,812	15.40	8.80	0.26
C67	Bladder	85,694	5.90	3.60	80,617	24.40	11.00	0.33	66,242	8.90	5.90	61,795	37.70	18.30	0.32	19,452	2.80	1.60	18,822	11.30	4.80	0.33
C70-72	Brain, central nervous system	79,575	5.50	4.10	24,538	7.40	5.40	0.76	40,942	5.50	4.20	13,763	8.40	6.20	0.68	38,633	5.50	3.90	10,775	6.40	4.70	0.83
C73	Thyroid	221,093	15.30	11.30	52,912	16.00	11.80	0.96	53,389	7.20	5.40	14,351	8.80	6.10	0.89	167,704	23.80	17.50	38,561	23.10	17.40	1.01
C81	Hodgkin's lymphoma	6,829	0.47	0.39	8,107	2.40	2.10	0.19	4,506	0.61	0.50	4,597	2.80	2.40	0.21	2,323	0.33	0.29	3,510	2.10	1.90	0.15
C82-86, C96	Non-Hodgkin's lymphoma	92,834	6.40	4.30	73,652	22.30	12.10	0.36	50,125	6.80	4.80	40,733	24.90	14.30	0.34	42,709	6.10	3.90	32,919	19.70	10.10	0.39
C88+C90	Multiple myeloma	21,116	1.50	0.91	32,119	9.70	4.90	0.19	12,215	1.60	1.10	18,085	11.00	5.90	0.19	8,901	1.30	0.75	14,034	8.40	4.00	0.19
C91-95	Leukaemia	85,404	5.90	5.10	61,152	18.50	11.10	0.46	48,600	6.50	5.80	35,574	21.70	13.40	0.43	36,804	5.20	4.50	25,578	15.30	9.00	0.50

ICD, International Statistical Classification of Diseases and Related Health Problems; ASIR, age-standardized incidence rates.

Table 2 Estimated mortality of cancer in the US and China in 2020

ICD	Cancer sites	Both							Male							Female						
		China			US			Mortality rate ratio (MRR)	China			US			Mortality rate ratio (MRR)	China			US			Mortality rate ratio (MRR)
		Deaths	Crude rate [1/105]	ASMR [1/105]	Deaths	Crude rate [1/105]	ASMR [1/105]		Deaths	Crude rate [1/105]	ASMR [1/105]	Deaths	Crude rate [1/105]	ASMR [1/105]		Deaths	Crude rate [1/105]	ASMR [1/105]	Deaths	Crude rate [1/105]	ASMR [1/105]	
C00-97	All cancers	3,002,899	207.50	129.40	612,390	185.00	86.30	1.50	1,820,002	245.30	163.90	322,028	196.60	98.10	1.67	1,182,897	167.70	98.10	290,362	173.60	76.90	1.28
C00-06	Lip, oral cavity	14,785	1.00	0.64	4,285	1.30	0.65	0.98	9,338	1.30	0.84	2,779	1.70	0.94	0.89	5,447	0.77	0.44	1,506	0.90	0.37	1.19
C07-08	Salivary glands	2,743	0.19	0.12	956	0.29	0.13	0.92	1,794	0.24	0.16	633	0.39	0.19	0.84	949	0.13	0.08	323	0.19	0.08	1.00
C09-10	Oropharynx	2,905	0.20	0.13	3,200	0.97	0.51	0.25	2,385	0.32	0.21	2,513	1.50	0.86	0.24	520	0.07	0.04	687	0.41	0.19	0.21
C11	Nasopharynx	34,810	2.40	1.60	915	0.28	0.16	10.00	25,118	3.40	2.30	644	0.39	0.23	10.00	9,692	1.40	0.87	271	0.16	0.08	10.88
C12-13	Hypopharynx	3,380	0.23	0.15	549	0.17	0.08	1.88	3,066	0.41	0.27	456	0.28	0.15	1.80	314	0.04	0.03	93	0.06	0.03	1.00
C15	Oesophagus	301,135	20.80	12.70	16,209	4.90	2.40	5.29	206,780	27.90	18.30	13,035	8.00	4.20	4.36	94,355	13.40	7.40	3,174	1.90	0.82	9.02
C16	Stomach	373,789	25.80	15.90	11,413	3.40	1.70	9.35	256,512	34.60	22.80	6,847	4.20	2.20	10.36	117,277	16.60	9.50	4,566	2.70	1.30	7.31
C18-21	Colorectum	286,162	19.80	12.00	54,443	16.40	8.00	1.50	164,959	22.20	14.80	28,899	17.60	9.40	1.57	121,203	17.20	9.40	25,544	15.30	6.70	1.40
C22	Liver	391,152	27.00	17.20	31,078	9.40	4.70	3.66	288,127	38.80	26.10	20,575	12.60	6.80	3.84	103,025	14.60	8.60	10,503	6.30	2.80	3.07
C23	Gallbladder	23,297	1.60	0.97	2,301	0.70	0.31	3.13	9,363	1.30	0.83	754	0.46	0.22	3.77	13,934	2.00	1.10	1,547	0.93	0.39	2.82
C25	Pancreas	121,853	8.40	5.10	47,683	14.40	6.60	0.77	67,882	9.10	6.00	24,933	15.20	7.70	0.78	53,971	7.70	4.20	22,750	13.60	5.60	0.75
C32	Larynx	15,814	1.10	0.67	3,833	1.20	0.57	1.18	13,471	1.80	1.20	3,041	1.90	0.97	1.24	2,343	0.33	0.19	792	0.47	0.22	0.86
C33-34	Lung	714,699	49.40	30.20	138,225	41.80	18.90	1.60	471,546	63.60	41.80	73,009	44.60	21.90	1.91	243,153	34.50	19.70	65,216	39.00	16.40	1.20
C43	Melanoma of skin	4,106	0.28	0.18	7,201	2.20	1.10	0.16	2,254	0.30	0.21	4,683	2.90	1.50	0.14	1,852	0.26	0.16	2,518	1.50	0.72	0.22
C45	Mesothelioma	2,768	0.19	0.12	2,538	0.77	0.31	0.39	1,622	0.22	0.14	1,927	1.20	0.50	0.28	1,146	0.16	0.10	611	0.37	0.15	0.67
C46	Kaposi sarcoma	162	0.01	0.01	92	0.03	0.02	0.50	91	0.01	0.01	77	0.05	0.04	0.25	71	0.01	0.01	15	0.01	-	
C50	Breast	117,174	16.60	10.00	42,617	25.50	12.40	0.81	–	–	–	–	–	–	–	117,174	16.60	10.00	42,617	25.50	12.40	0.81
C51	Vulva	1,228	0.17	0.10	1,487	0.89	0.35	0.29	–	–	–	–	–	–	–	1,228	0.17	0.10	1,487	0.89	0.35	0.29
C52	Vagina	682	0.10	0.06	414	0.25	0.10	0.60	–	–	–	–	–	–	–	682	0.10	0.06	414	0.25	0.10	0.60
C53	Cervix uteri	59,060	8.40	5.30	5,706	3.40	2.10	2.52	–	–	–	–	–	–	–	59,060	8.40	5.30	5,706	3.40	2.10	2.52
C54	Corpus uteri	16,607	2.40	1.40	11,460	6.90	3.10	0.45	–	–	–	–	–	–	–	16,607	2.40	1.40	11,460	6.90	3.10	0.45
C56	Ovary	37,519	5.30	3.30	14,359	8.60	4.00	0.83	–	–	–	–	–	–	–	37,519	5.30	3.30	14,359	8.60	4.00	0.83
C60	Penis	1,565	0.21	0.14	414	0.25	0.13	1.08	1,565	0.21	0.14	414	0.25	0.13	1.08	–	–	–	–	–	–	–
C61	Prostate	51,094	6.90	4.60	32,438	19.80	8.20	0.56	51,094	6.90	4.60	32,438	19.80	8.20	0.56	–	–	–	–	–	–	–
C62	Testis	851	0.11	0.09	450	0.27	0.23	0.39	851	0.11	0.09	450	0.27	0.23	0.39	–	–	–	–	–	–	–
C64-65	Kidney	43,196	3.00	1.90	14,589	4.40	2.10	0.90	29,147	3.90	2.60	9,500	5.80	3.00	0.87	14,049	2.00	1.10	5,089	3.00	1.30	0.85
C67	Bladder	39,393	2.70	1.60	18,130	5.50	2.10	0.76	29,678	4.00	2.70	13,055	8.00	3.40	0.79	9,715	1.40	0.72	5,075	3.00	1.00	0.72
C70-72	Brain, central nervous system	65,204	4.50	3.20	18,133	5.50	3.20	1.00	33,658	4.50	3.30	10,230	6.20	3.80	0.87	31,546	4.50	3.00	7,903	4.70	2.60	1.15
C73	Thyroid	9,261	0.64	0.40	2,161	0.65	0.30	1.33	3,386	0.46	0.31	1,033	0.63	0.32	0.97	5,875	0.83	0.48	1,128	0.67	0.28	1.71
C81	Hodgkin's lymphoma	2,807	0.19	0.14	943	0.28	0.15	0.93	1,865	0.25	0.18	562	0.34	0.19	0.95	942	0.13	0.09	381	0.23	0.10	0.90
C82-86, C96	Non-Hodgkin's lymphoma	54,351	3.80	2.40	20,858	6.30	2.70	0.89	29,721	4.00	2.80	12,075	7.40	3.50	0.80	24,630	3.50	2.10	8,783	5.30	1.90	1.11
C88 + C90	Multiple myeloma	16,182	1.10	0.69	13,426	4.10	1.70	0.41	9,688	1.30	0.86	7,588	4.60	2.20	0.39	6,494	0.92	0.53	5,838	3.50	1.30	0.41
C91-95	Leukaemia	61,694	4.30	3.30	23,753	7.20	3.20	1.03	35,664	4.80	3.80	13,859	8.50	4.10	0.93	26,030	3.70	2.80	9,894	5.90	2.50	1.12

ICD, International Statistical Classification of Diseases and Related Health Problems; ASMR, age-standardized mortality rate.

long-term key health expenditures and the participation of all people. Referencing the current cancer statistics and diagnosis and treatment in the US, comparing the differences between China and the US, and learning from the US prevention and treatment experience will help to explore prevention and treatment measures with Chinese characteristics based on China's current basic national conditions.

Cancer spectrum differences

This study compares the latest cancer statistics in China and the US from the incidence and mortality. The incidence rate of all cancer in China is lower than that in the US, while the mortality rate is the opposite. The main reason is the different tumor spectrum. Liver cancer, gastric cancer, esophageal cancer, cervical cancer, etc. are common tumor types in China, and their incidence and mortality are significantly higher than those in the US. Digestive system tumors with poor prognosis are more in China. The incidence of prostate cancer, colorectal cancer and breast cancer in the US is much higher than that in China, but the prognosis is relatively good (7,8). Other cancers that are also relatively common in the US, such as bladder cancer, skin cancer, kidney cancer, and oral cancer, are rare in China. It is worth mentioning that the future trend is also different among various cancer types. The three major digestive system tumors in Chinese men, including esophageal cancer, stomach cancer, and liver cancer, have gradually shown a downward trend. The types of cancers related to lifestyle are on the rise, such as colorectal cancer and prostate cancer (9). But after adjusting the age, the trend slowed down. Chinese women's breast cancer, colorectal cancer, and thyroid cancer are still showing a significant upward trend, but the incidence of upper digestive system tumors is declining (9).

Aging population

In addition to differences in the tumor spectrum, another major problem facing cancer prevention and control in China is aging. Cancer is a type of disease closely related to age. Although the age-standardized incidence and mortality rates in the US have declined, the increasing aging of the population makes the US' cancer control work still under pressure. With the dual decline of population fertility and mortality, China will face the same aging challenge now and for a long time in the future. In 2020, the proportion of people over the age of 65 in the total population in my country has reached 13.5% (1), which is higher than the world's recognized warning line of 7% of an aging society and is approaching the 14% threshold of deep aging (10). The growth of the elderly population has caused a continuous increase in the incidence of cancer. The medical service needs of elderly cancer patients will pose major challenges to the government in terms of quantity and complexity. From 2000 to 2015, the ASIR of cancer in China stabilized among men, and slightly increased among women. The ASMR declined for both males and females. However, after including the unavoidable factor of population aging, it can be found that the mortality rate of malignant tumors in China has gradually increased from 1990 to 2016, both in urban and rural areas, regardless of men and women (9,11).

Economic and environmental factors

The development of economy and science and technology affects people's living and medical standards. In China, there is still a considerable part of the population in the area of relatively lagging behind in economy and health care. Therefore, under different economic backgrounds, there are "poverty cancer" and "wealth cancer". The digestive system tumors with high incidence in China are more likely to be characterized by "poverty cancer", while lung cancer, breast cancer, prostate cancer and colorectal cancer, which rank high in the US, represent "wealth cancer". Economic development comes at the cost of environmental (air, water, soil, etc.) pollution. In both countries, studies have shown that changes in the concentration of atmospheric pollutants can affect the potential lifespan of residents, most notably lung cancer, and that water pollution is associated with an increased risk of digestive-related cancers (12,13). As a model of industrialized countries, the US has also experienced the road of pollution and treatment, which has important reference significance in the prevention and control of economic and environmental factors.

Preventable carcinogenic risk factors

The high incidence of digestive system cancer in China has a lot to do with China's food culture, such as the prevalence of drinking culture, high-salt eating habits, preference for pickled foods, etc. These eating habits can easily cause damage to the mucosa of the digestive tract and greatly increase the risk of gastrointestinal cancer.

The accumulating damage cancer caused by bad lifestyle habits cannot be ignored. Tobacco control can reduce the incidence of lung cancer, and avoiding high-fat diets can reduce the incidence of bowel cancer. Primary prevention plays a crucial role in cancer prevention. The effectiveness of tobacco control in the US has attracted worldwide attention. The adult smoking rate has dropped from 42.4% in 1990 to 14.0% in 2019 (3). The smoking rate of men is 15.3%, which is not much different from that of women (12.7%). The continued decline in smoking prevalence has led to a significant decline in the incidence of lung cancer in the US, especially in men. However, the monitoring results of adult risk factors in China showed that the smoking rate of men is 53.3%, the proportion of drinking in the past 30 days of men is 47.6%, the dangerous drinking rate is 9.3%, the rate of smoking and drinking among young people is still rising. And the proportion of residents who never exercise is up to 83.8%. Overweight and obesity showed a significant upward trend, the adult overweight rate reached 30.6%, the obesity rate reached 12.0% (14). Cancer-related unhealthy lifestyles are still on the rise in China. We should vigorously promote education and popularize scientific knowledge of cancer prevention.

Early screening

Screening makes the diagnosis period generally early. Early detection contributes to a higher survival rate. According to the US CDC, the adherence rates in screening programs were relatively high in the US, with an adherence rate of 71.6%, 82.8%, and 62.4% for screening breast, cervical and colorectal cancer, respectively (15). This makes mortality rates of these three cancers have dropped significantly, and the incidence of colorectal cancer has also shown a downward trend. The early diagnosis and treatment of cancer in China has been carried out as early as the 1950s. By the 1980s, it has been expanded to more than 60 high cancer sites, and cancer screening has covered millions of people (16). The practices of diagnosis and early treatment, such as esophageal cancer in Linxian and Cixian, liver cancer in Qidong, colorectal cancer in Jiashan and Haining, cervical cancer in Xiangyuan, nasopharyngeal cancer in Sihui, gastric cancer in Yangzhong, and lung cancer in Gejiu and Wuwei, have provided valuable experience for cancer prevention and treatment in China and the world. However, due to the weak economic foundation, it has not been widely carried out. Since 2005, the Ministry of Finance and the Ministry of Health have included the cancer early diagnosis and treatment project into the central subsidy for local health special funds. The funding has increased from 5 million to more than 50 million, and the number of people screened each year has reached 100,000. From 2009 to 2011, a major national public health project-the "two-cancer examination" for rural women was launched, covering 10 million women in 221 counties. In 2012, the urban cancer early diagnosis and treatment project has covered more than 2 million people in 18 provinces across the country (17). However, these national projects have so far covered less than 20 million people, which is only a drop in the bucket compared with hundreds of millions of high-risk groups or screening target groups. Fortunately, Shanghai, Tianjin, and Guangzhou, which have a better economic foundation, have successively launched large-scale population colorectal cancer screening projects in recent years. Tianjin has screened more than 2 million people (18), and Shanghai is the first in the country to incorporate it into public health services, which has rapidly expanded the coverage of colorectal cancer screening (19). Locally-led and state-supported cancer screening project implementation strategies can effectively solve the problems of unbalanced demand and resources, and will be more sustainable (20). However, the residents' autonomous early screening awareness still needs to be further improved. The ability to do less frequent and more targeted screening to optimize the risk/benefit tradeoffs is the challenge we face currently. In addition to universal screening, because some tumors are genetic, the detection of mutant genes in specific high-risk populations and effective prevention or intervention taken for the carriers are important measures to prevent tumors. For example, some studies have reported that the prevalence of BRCA1/BRCA2 pathogenic variants in Chinese Han population was about 0.38% (21), which is lower than that in the US (22,23). This may partly explain the difference in breast cancer incidence between China and the US.

Treatment

Improvements in treatment have also contributed to a decline in cancer mortality. The difference in 5-year survival rates due to treatment between the two countries is shrinking. Take breast cancer as an example. Among female patients in China and the US, breast cancer is the one with the highest incidence rate. As of 2018 data, the overall 5-year survival rate of breast cancer patients in China is 82% (8), compared with 90% in the US (24). There is only

an 8% difference in the 5-year survival rate for this cancer. With the progress of domestic breast cancer screening and standardized diagnosis and treatment in recent years, this proportion is still shrinking. On the other hand, the 5-year survival rates of several high-incidence cancers in China, such as esophageal cancer and gastric cancer, are higher than that in the US (4). However, China is still relatively lagging behind in the innovation of treatment methods and drugs. Continue to improve the national monitoring of the clinical application of anticancer drugs, strengthen the quality control of standardized cancer diagnosis and treatment, and promote the multidisciplinary diagnosis and treatment model of cancer are the future direction.

Several potential limitations should be noted when interpreting the findings. The impact of the global COVID-19 pandemic on decreased access to health care, including suspension of screening programs, and delayed cancer diagnosis and treatment might cause a short-term decline in cancer incidence followed by increases in advanced-stage diagnoses and cancer mortality in some settings, which is not reflected in the GLOBOCAN estimates. Other indicators of burden of cancer such as disability-adjusted life year (DALY) and potential years of life lost (PYLL) need to be analyzed in future studies.

With the process of urbanization and aging in China, the prevalence of westernized lifestyles in the period of economic transformation, and the accumulation of environmental pollution and occupational exposure in the process of industrialization, the burden of cancer will probably exacerbate. Therefore, it is more necessary to adopt a multi-pronged approach and adopt extensive and comprehensive prevention and control measures to improve the overall cancer survival rate. The provision of standardized, equal, and appropriate cancer diagnosis and treatment services can be listed as a priority item.

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