

Preplanned Studies

Burden of Disease Due to Cancer — China, 2000–2019

Xueqi Fan¹; Bin Zhang^{1,2}; Yuan He^{1,3}; Xiaolong Zhou¹; Yingying Zhang⁴; Li Ma⁴; Xudong Li^{4,†}; Jing Wu^{1,†}**Summary****What is already known about this topic?**

Cancer is a major global public health problem and the leading cause of death in China. China has a large population, and therefore has a significant proportion of the global burden of cancer.

What is added by this report?

The age-standardized incidence of cancer has increased in China, while the cancer mortality rate has decreased. Compared with younger age groups, individuals over 70 have a greater burden of cancer. Digestive tract cancer and breast cancer should be targeted for prevention, treatment, and control.

What are the implications for public health practices?

To effectively reduce the burden of cancer, early screening of key populations and age groups should be strengthened, and targeted and precise prevention and control strategies should be adopted.

According to the World Health Organization (WHO), cancer is the second most common cause of death in the world (1). China has made considerable efforts to prevent and control cancer, but cancer is still a major national health problem. To understand the current burden of cancer in China, we analyzed the most recent estimates from the Global Burden of Disease Study (GBD 2019). GBD 2019 estimated the burden of disease in China using multiple data sources with unified and internationally comparable methods to comprehensively evaluate cancer mortality and risk factor trends in China. Compared to the standardized incidence of cancer in 2000, the standardized incidence of cancer increased in 2019, the standardized mortality rate decreased, and the number of deaths increased. People older than 70 years of age had the largest burden of cancer in 2019. In particular, breast cancer among females rose in the ranking, ranked by disability-adjusted life years (DALYs), among both sexes in 2019 in China and therefore requires more attention. To reduce the burden of cancer in China, effective cancer prevention and control measures are

essential.

Data from 2000 and 2019 GBD studies for comparisons and analyses that included incidence, prevalence, mortality, and burden of cancer were extracted. Standardized rates were based on international populations in 2010 and calculations were based on standardized populations. DALYs refers to the total number of healthy life years lost from the time of illness onset through death, including years of life lost due to premature mortality (years of life lost; YLLs) and years lived with disability (YLDs).

Table 1 shows the incidence, prevalence, and mortality of cancer by gender in China. In 2019, cancer incidence, prevalence, and mortality were 244.75, 973.80, and 140.66 per 100,000 total population — increased by 15.85%, 68.62%, and -18.04%, respectively, compared to those of 2000. The cancer burden among men was significantly higher than among women. The 2019 standardized DALYs, YLLs, and YLDs increased by -24.14%, -25.14%, and 40.77%, respectively, compared to those of 2000.

As shown in Table 2, the burden of cancer was the greatest in people over 70 years of age, with standardized incidence, prevalence, and mortality of 1,545.58 (per 100,000), 4,137.77 (per 100,000), and 1,173.86 (per 100,000), respectively, in 2019. The incidence of cancer in the 15–49 age group increased 36.72% compared to that of 2000.

As shown in Table 3, the leading five cancer categories, as ranked by DALYs rate, were tracheal, bronchial, and lung cancers; stomach cancer; colon and rectal cancers; esophageal cancer; and liver cancer. There were large differences by gender in 2019, and by 2019, the DALYs rate rankings of cancer, regardless of gender, changed greatly compared to those of 2000. However, for both men and women, lung cancer DALYs rate consistently ranked first. The 2019 DALYs rate rankings significantly changed compared to those of 2000, such that the ranking of colon and rectal cancer changed from sixth to third, liver cancer among men changed from third to fifth, and breast cancer among women changed from fourth to second.

TABLE 1. Overall incidence, prevalence, deaths, and burden indicators of all cancers, 2000 and 2019 in China.

Gender	Year	Incidence			Prevalence			Deaths			DALYs			YLLs			YLDs		
		N	P'	N	N	P'	N	N	P'	N	P'	N	P'	N	P'	N	P'	N	P'
Male	2000	1,410,333	259.59	3,199,721	547.30	1,170,487	228.45	33,786,674	5,668.74	33,362,468	5,593.31	424,206	75.43						
	2019	2,860,622	309.56	9,723,166	1,030.87	1,746,217	197.23	43,473,268	4,521.80	42,425,745	4,409.62	1,047,523	112.17						
	2019 vs. 2000 (%)*	102.83	19.25	203.88	88.35	49.19	-13.67	28.67	-20.23	27.17	-21.16	146.94	48.71						
Female	2000	1,004,000	170.90	3,824,258	620.22	694,220	124.12	20,530,328	3,385.92	20,149,716	3,323.05	380,612	62.87						
	2019	1,897,540	191.89	9,056,014	935.05	965,678	95.79	23,867,041	2,402.12	23,055,521	2,319.25	811,520	82.87						
	2019 vs. 2000 (%)*	89.00	12.28	136.80	50.76	39.10	-22.82	16.25	-29.06	14.42	-30.21	113.21	31.81						
Both	2000	2,414,332	211.27	7,023,979	577.51	1,864,707	171.62	54,317,002	4,496.44	53,512,183	4,428.32	804,819	68.13						
	2019	4,758,162	244.75	18,779,180	973.80	2,711,895	140.66	67,340,309	3,411.12	65,481,266	3,315.22	1,859,042	95.90						
	2019 vs. 2000 (%)*	97.08	15.85	167.36	68.62	45.43	-18.04	23.98	-24.14	22.37	-25.14	130.99	40.77						

Note: N: Number of cases for incidence, prevalence, and deaths; number of person years for disability-adjusted life years (DALYs), years of life lost (YLLs), and years lived with disability (YLDs).

P': Standardized rate calculated using the 2010 National Census as the standard population, expressed as 1/100,000.

* Percent change (%) was calculated as difference value between 2019 and 2000 divided by quantity in 2000.

Abbreviations: DALYs=disability-adjusted life years; YLLs=years of life lost; YLDs=years lived with disability.

TABLE 2. Incidence, prevalence, deaths, and burden indicators of cancer, 2000 and 2019 in China.

Age group (years)	Year	Incidence		Prevalence		Deaths		DALYs		YLLs		YLDs	
		N	P'	N	P'	N	P'	N	P'	N	P'	N	P'
<15	2000	105,651	34.28	711,665	230.88	32,244	10.46	2,713,576	880.34	2,656,207	861.73	57,369	18.61
	2019	60,959	27.12	459,596	204.47	11,053	4.92	946,887	421.25	912,783	406.08	34,104	15.17
	2019 vs. 2000 (%)*	-42.30	-20.88	-35.42	-11.44	-65.72	-52.99	-65.11	-52.15	-65.64	-52.88	-40.55	-18.48
15-49	2000	594,899	79.73	2,481,389	332.56	346,451	46.43	17,176,324	2,302.02	16,933,876	2,269.52	242,448	32.49
	2019	785,629	109.01	4,538,621	629.73	257,870	35.78	12,711,343	1,763.69	12,328,951	1,710.63	382,391	53.06
	2019 vs. 2000 (%)*	32.06	36.72	82.91	89.36	-25.57	-22.94	-25.99	-23.39	-27.19	-24.63	57.72	63.28
50-69	2000	1,021,067	534.20	2,654,155	1,388.59	800,805	418.96	23,665,394	12,381.16	23,343,021	12,212.50	322,373	168.66
	2019	2,242,887	608.02	9,313,626	2,524.82	1,175,611	318.70	34,719,458	9,412.07	33,820,598	9,168.39	898,860	243.67
	2019 vs. 2000 (%)*	119.66	13.82	250.91	81.83	46.80	-23.93	46.71	-23.98	44.89	-24.93	178.83	44.48
70+	2000	692,715	1,261.05	1,176,770	2,142.24	685,208	1,247.38	10,761,709	19,591.10	10,579,080	19,258.63	182,629	332.47
	2019	1,668,686	1,545.58	4,467,337	4,137.77	1,267,361	1,173.86	18,962,621	17,563.70	18,418,934	17,060.12	543,687	503.58
	2019 vs. 2000 (%)*	140.89	22.56	279.63	93.15	84.96	-5.89	76.20	-10.35	74.11	-11.42	197.70	51.47

Note: N: Number of cases for incidence, prevalence, and deaths; number of person years for disability-adjusted life years (DALYs), years of life lost (YLLs), and years lived with disability (YLDs).

P': Standardized rate calculated using the 2010 National Census as the standard population, expressed as 1/100,000.

* Percent change (%) was calculated as difference value between 2019 and 2000 divided by the 2000 value.

Abbreviations: DALYs=disability-adjusted life years; YLLs=years of life lost; YLDs=years lived with disability.

TABLE 3. Cancers ranked by DALYs rate among both sexes between 2000 and 2019 in China.

Year	Rank	Cancer site	Both sexes (1/100,000)	Cancer site	Male	Cancer site	Female
2019	1	Tracheal, bronchus, and lung	831.27	Tracheal, bronchus, and lung	1,203.78	Tracheal, bronchus, and lung	492.17
	2	Stomach	481.15	Stomach	718.79	Breast	277.98
	3	Colon and rectal	320.57	Esophageal	458.55	Stomach	260.97
	4	Esophageal	277.50	Colon and rectal	434.50	Colon and rectal	217.28
	5	Liver	264.31	Liver	414.90	Cervical	157.50
	6	Leukemia	163.82	Leukemia	190.81	Leukemia	135.97
	7	Breast	144.15	Pancreatic	176.41	Liver	115.85
	8	Pancreatic	136.57	Brain and central nervous system	143.02	Brain and central nervous system	109.48
	9	Brain and central nervous system	126.24	Prostate	118.94	Esophageal	108.46
	10	Cervical	79.10	Non-Hodgkin lymphoma	95.58	Pancreatic	98.93
2000	1	Tracheal, bronchus, and lung	826.23	Tracheal, bronchus, and lung	1173.00	Stomach	519.17
	2	Stomach	796.94	Stomach	1085.18	Tracheal, bronchus, and lung	498.15
	3	Liver	689.47	Liver	1029.41	Liver	339.82
	4	Esophageal	499.63	Esophageal	713.66	Breast	296.44
	5	Leukemia	293.96	Colon and rectum	302.27	Esophageal	289.29
	6	Colon and rectum	258.69	Leukemia	301.19	Leukemia	288.00
	7	Brain and central nervous system	161.76	Brain and central nervous system	175.24	Colon and rectum	220.04
	8	Breast	147.71	Prostate	126.41	Cervical	157.07
	9	Pancreatic	95.80	Pancreatic	115.71	Brain and central nervous system	148.11
	10	Cervical	77.67	Nasopharyngeal	101.15	Pancreatic	76.45

Note: DALY rate: Standardized rate calculated using the 2010 National Census as the standard population, expressed as 1/100,000.
Abbreviation: DALY=disability-adjusted life years.

DISCUSSION

China has a high incidence of cancer. Both incidence and prevalence were on the rise in 2019, while the cancer mortality rate was decreasing. DALYs and YLLs were also decreasing, but YLDs increased. Although mortality rates have declined, the combination of an aging and growing population has resulted in the absolute number of cancer deaths increasing by 45.43% in 2019 compared to that of 2000. In addition, progress in China's medical technology influences the trends. The burden of cancer is greater in men than women, possibly related to men's greater exposure to occupational risk factors, high social pressure, and poorer lifestyles. China has taken a series of effective measures in response to cancer, including promoting tobacco control, pushing for hepatitis B and human papilloma virus (HPV) vaccination to strengthen primary prevention, and developing guidelines for early screening, early diagnosis, and early treatment of cancers.

DALYs rate peaked in the 70-year-old age group, indicating that the elderly are living longer. The 15–49-year age group had the largest increase in cancer incidence, indicating that the burden of cancer is shifting to a younger population. This is consistent with the results of a previous study (2), and it shows that it is necessary and important for China to actively conduct cancer screening for early diagnosis and treatment. To effectively reduce the burden of cancer, precise prevention and control of key populations need to be implemented.

The overall DALYs rate rankings of specific cancers only changed slightly from 2000 to 2019, but the DALYs rate rankings among females changed more significantly. Lung cancer rankings did not change from 2000 — lung cancer still ranks first among both men and women. In many countries, lung cancer is the leading cause of cancer death. The high ranking of lung cancer DALYs rate among women may be related to outdoor air pollution and the use of indoor solid fuels for heating and cooking (3–4).

The DALYs rate ranking of colorectal cancer increased from sixth to third from 2000 to 2019. Colorectal cancer risk is closely related to lifestyle. Increased intake of animal-derived foods, obesity caused by prolonged sitting, and unhealthy habits, such as smoking and drinking, are related to the risk of colorectal cancer (5). An important strategy to reduce the burden of colorectal cancer is strengthening

primary and secondary prevention.

Breast cancer rose from fourth rank to second rank among women. The change may be due to changes in lifestyle and social culture brought about by economic growth and increases in the proportion of women in the industrial labor force — both of which are associated with breast cancer (6). In 2020, breast cancer surpassed lung cancer as the leading cause of cancer globally. WHO recommended that women with an average risk of breast cancer between the ages of 50 and 69 undergo organized, population-based mammography every 2 years in well-resourced countries (7).

Liver cancer decreased from third to fifth rank overall, and among women, liver cancer decreased from third to seventh rank. Although the results of this study showed that China's DALYs rate ranking of liver cancer decreased in 2019, the burden of cancer in China will increase further because of population aging. A study showed that limited coverage of health examinations and screenings in China also indicated that the overall 5-year survival rate for liver cancer is low (8). Therefore, China should expand adult vaccination to control hepatitis B virus infection and increase hepatitis B virus screening.

This study was subject to several limitations. The study was at the national level and did not include provincial-level data. Economic and medical development varied by region, which might lead to regional differences in the burden of cancer. GBD 2019 data was estimated by model, and some relevant data were unavailable for earlier years. However, by comparing our data with published articles (9), the trends of cancer in China were shown to be roughly the same as in previous studies. In the future, in-depth research is needed for different provinces in China. In addition, tumor registries should be expanded by area as much as possible to make the data higher quality and as accurate as possible in China.

With China's aging population, the size of the elderly population will increase, and the burden of cancer will also become greater. In anticipation of this trend, China developed the Healthy China Initiative 2019–2030 (10), which includes cancer prevention and treatment as a major special action, requiring the overall 5-year survival rate of cancer to be greater than 46.6% in 2030 and the early diagnosis rate of key cancer types in high-incidence areas to be greater than 55% in 2022, with further increases required in the future (10). Early cancer screening with early diagnosis

and treatment should be promoted by improving health laws and regulations and improving the medical security system, publicity and education should be carried out appropriately, and residents' attention to cancer prevention and response should be increased so that the overall burden of cancer in China would gradually and steadily decrease.

Acknowledgements: The GBD 2019 team and the National Center for Chronic and Noncommunicable Disease Control and Prevention, Chinese Center for Disease Control and Prevention.

Conflicts of interest: No conflicts of interest.

Funding: Supported by National Key Research and Development Program "Research on key technologies for monitoring and controlling major malignant tumor risk factors based on big data, guided by precise prevention and control" (2016YFC1302600).

doi: [10.46234/ccdcw2022.036](https://doi.org/10.46234/ccdcw2022.036)

Corresponding authors: Xudong Li, lixd@chinacdc.cn; Jing Wu, wujingcdc@163.com.

¹ National Center for Chronic and Noncommunicable Disease Control and Prevention, CDC China, Beijing, China; ² Inner Mongolia Medical University, Huhehot, Inner Mongolia Autonomous Region, China; ³ Baotou Medical College, Baotou, Inner Mongolia Autonomous Region, China; ⁴ Office of Epidemiology, Chinese Center for Disease Control and Prevention, Beijing, China.

Submitted: June 29, 2021; Accepted: October 26, 2021

REFERENCES

1. WHO. Global health estimates 2020: deaths by cause, age, sex, by country and by region, 2000-2019. https://www.sohu.com/a/451622343_120910877. [2021-2-20].
2. Zhai Z, Zheng Y, Li N, Deng YJ, Zhou LH, Tian T, et al. Incidence and disease burden of prostate cancer from 1990 to 2017: results from the global burden of disease study 2017. *Cancer* 2020;126(9):1969 – 78. <http://dx.doi.org/10.1002/cncr.32733>.
3. Mu LN, Liu L, Niu RG, Zhao BX, Shi JP, Li YL, et al. Indoor air pollution and risk of lung cancer among Chinese female non-smokers. *Cancer Causes Control* 2013;24(3):439 – 50. <http://dx.doi.org/10.1007/s10552-012-0130-8>.
4. Turner MC, Andersen ZJ, Baccarelli A, Diver WR, Gapstur SM, Pope III CA, et al. Outdoor air pollution and cancer: an overview of the current evidence and public health recommendations. *CA Cancer J Clin* 2020;70(6):460 – 79. <http://dx.doi.org/10.3322/caac.21632>.
5. Siegel RL, Miller KD, Sauer AG, Fedewa SA, Butterly LF, Anderson JC, et al. Colorectal cancer statistics, 2020. *CA Cancer J Clin* 2020;70(3):145 – 64. <http://dx.doi.org/10.3322/caac.21601>.
6. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin* 2021;71(3):209 – 49. <http://dx.doi.org/10.3322/caac.21660>.
7. WHO. WHO position paper on mammography screening. Geneva: World Health Organization. 2014. <https://apps.who.int/iris/handle/10665/137339>.
8. Zeng HM, Chen WQ, Zheng RS, Zhang SW, Ji JS, Zou XN, et al. Changing cancer survival in China during 2003-15: a pooled analysis of 17 population-based cancer registries. *Lancet Glob Health* 2018;6(5):e555 – 67. [http://dx.doi.org/10.1016/S2214-109X\(18\)30127-X](http://dx.doi.org/10.1016/S2214-109X(18)30127-X).
9. Chen WQ, Zheng RS, Baade PD, Zhang SW, Zeng HM, Bray F, et al. Cancer statistics in China, 2015. *CA Cancer J Clin* 2016;66(2):115 – 32. <http://dx.doi.org/10.3322/caac.21338>.
10. Healthy China Action Promotion Committee. Healthy China initiative (2019-2030). <http://www.nhc.gov.cn/guihuaxxs/s3585u/201907/e9275fb95d5b4295be8308415d4cd1b2.shtml>. [2020-12-22]. (In Chinese).