Cancer statistics in China and United States, 2022: profiles, trends, and determinants

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Abstract

Background: The cancer burden in the United States of America (USA) has decreased gradually. However, China is experiencing a transition in its cancer profiles, with greater incidence of cancers that were previously more common in the USA. This study compared the latest cancer profiles, trends, and determinants between China and USA.

Methods: This was a comparative study using open-source data. Cancer cases and deaths in 2022 were calculated using cancer estimates from GLOBOCAN 2020 and population estimates from the United Nations. Trends in cancer incidence and mortality rates in the USA used data from the Surveillance, Epidemiology, and End Results program and National Center for Health Statistics. Chinese data were obtained from cancer registry reports. Data from the Global Burden of Disease 2019 and a decomposition method were used to express cancer deaths as the product of four determinant factors.

Results: In 2022, there will be approximately 4,820,000 and 2,370,000 new cancer cases, and 3,210,000 and 640,000 cancer deaths in China and the USA, respectively. The most common cancers are lung cancer in China and breast cancer in the USA, and lung cancer is the leading cause of cancer death in both. Age-standardized incidence and mortality rates for lung cancer and colorectal cancer in the USA have decreased significantly recently, but rates of liver cancer have increased slightly. Rates of stomach, liver, and esophageal cancer decreased gradually in China, but rates have increased for colorectal cancer in the whole population, prostate cancer in men, and other seven cancer types in women. Increases in adult population size and population aging were major determinants for incremental cancer deaths, and case-fatality rates contributed to reduced cancer deaths in both countries.

Conclusions: The decreasing cancer burden in liver, stomach, and esophagus, and increasing burden in lung, colorectum, breast, and prostate, mean that cancer profiles in China and the USA are converging. Population aging is a growing determinant of incremental cancer burden. Progress in cancer prevention and care in the USA, and measures to actively respond to population aging, may help China to reduce the cancer burden.

Keywords: Cancer; Incidence; Mortality; Trends; Aging; China; USA

Introduction

Cancer is the leading cause of deaths in China and developed countries.1,2 GLOBOCAN 2020 estimated that there were 19,292,789 cancer cases and 9,958,133 cancer deaths globally in 2020.3 The number of cancer cases and deaths, as well as crude incidence and mortality of cancer in China have increased gradually since 2000.4,5 In the United States of America (USA), however, age-standardized rates of cancer incidence in men and cancer mortality in the whole population have generally decreased since the early 1990s.6,7 Long-term trends in cancer burden and rates reflect both patterns in behaviors associated with cancer risk and changes in medical practice, such as the use of cancer screening tests. The relatively successful progress in cancer research, prevention, and care in the USA may provide lessons for other countries.6

China is making efforts to confront its rapidly increasing cancer burden.8 However, rapid population aging and accumulated effects of risk factor exposure mean that it faces many new challenges for cancer prevention. A comparison of cancer profiles, trends, and determinants between China and the USA may inform activities and policy making around cancer prevention in China. We therefore carried out a comparative study to report cancer burden, long-term trends in cancer incidence and mortality.

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rates, and the contributions of four determinant factors to incremental cancer deaths.

Methods

Data sources

We used open-source data from GLOBOCAN 2020 released by the International Agency for Research on Cancer,[8] the 2019 revision of World Population Prospects released by the United Nations (UN),[9] the Surveillance, Epidemiology, and End Results (SEER) program released by the National Center for Health Statistics,[5] cancer registry data released by the National Cancer Center (NCC) of China,[10] and the Global Burden of Disease (GBD) 2019 released by the Institute for Health Metrics and Evaluation.[11] Cancer data from GLOBOCAN 2020 and population estimates from UN were used to estimate the cancer profile rates in China and the USA in 2022. Longitudinal cancer data from SEER and China NCC were used in the trend analyses. Data from GBD 2019 were used to analyze the determinant factors of cancer deaths.

From the GLOBOCAN 2020 database, we extracted sex- and age-specific estimates of cancer cases and deaths for 35 cancer types (including all cancers combined) in China and the USA in 2020. The corresponding population estimates for 2020 and projections to 2022 were downloaded from the UN website by sex and age. For the 14 cancer types included in the trend analyses (10 cancer types for cancer cases and deaths among men and women in China in 2000),[10] we collected age-standardized cancer incidence rate from 1975 to 2018 and age-standardized cancer mortality rate from 1975 to 2019 in the USA from the SEER interactive website. Age-standardized cancer incidence and mortality in China between 2000 and 2015 were extracted from the previous published cancer registry report.[10] From the GBD 2019 database, we collected year-, sex-, and age-specific estimates of cancer cases and deaths for 29 cancer types in China and the USA between 1990 and 2019, accompanied by the corresponding population estimates.

Statistical analysis

Using the same methodology as GLOBOCAN 2020,[12] we linked cancer cases and deaths to the corresponding population estimates released by the UN. Age-specific cancer incidence and mortality rate in 2020 were calculated for 35 cancer types and by sex. We assumed that the age-specific rate in 2022 would remain constant at the rates estimated in 2020.[13] Cancer cases and deaths in 2022 in China and the USA were calculated by multiplying the age-specific rate by population estimates in 2022, and then aggregated by 35 cancer types (including all cancers combined) and sex. Cancer profiles in China in 2022 were estimated for Chinese mainland, Hong Kong, and Macau. Taiwan province was not included because of lack of data in GLOBOCAN 2020. Cancer profiles in the USA in 2022 were estimated for 50 states and the District of Columbia, but not the dependencies.

Trends in cancer incidence and mortality rates were reported separately by sex. Rates for USA cancer incidence (1975–2018) and mortality (1975–2019) were adjusted by 2000 USA standard population. Rates for cancer incidence and mortality (2000–2015) in China were adjusted by Segi’s world standard population. A total of 14 cancer types were included in the trend analysis, including the top 10 cancer types in China in 2000 by incidence (lung, stomach, liver, esophagus, colorectum, bladder, pancreas, brain and central nervous system (CNS), leukemia, and prostate) and mortality (lung, liver, stomach, esophagus, colorectum, pancreas, brain and CNS, leukemia, bladder, and prostate) in males, and by incidence (breast, lung, stomach, colorectum, esophagus, liver, uterus, brain and CNS, thyroid, and cervix) and mortality (lung, stomach, liver, esophagus, colorectum, breast, brain and CNS, uterus, cervix, and thyroid) in females.[4,10]

Using the cancer deaths in 1990 as a reference, we used a decomposition method to express cancer deaths as the product of four determinant factors (ie, population aging, population size, age-specific cancer incidence rate, and case-fatality rate) among men and women aged 25 years and older from 1991 to 2019.[14,15] The four determinants corresponded to the four terms shown in the sum below:[14-16]

$$\text{Death}_{a,c,y} = \sum_{a,c} \left( \frac{\text{Pop size}_{a,y}}{\text{Pop size}_{a,y}} \cdot \frac{\text{Pop age}_{a,y}}{\text{Case}_{a,c,y}} \cdot \frac{\text{Case}_{a,c,y}}{\text{Death}_{a,c,y}} \right)$$

where $a$ represents the 5-year age groups of men and women aged 25 years and older (up to 90 years and older), $c$ represents the cancer type, and $y$ represents the year. Cancer deaths attributable to the four determinant factors were calculated for 29 cancer types by sex, and then summed to give the total attributable cancer deaths in that year. The proportions of attributable cancer deaths among total cancer deaths in that year were calculated and the time trends between 1991 and 2019 were assessed.

Results

Profiles of cancer cases and deaths in 2022

The estimated numbers of new cancer cases and deaths in China (Taiwan province were not included) and the USA (excluding dependencies) in 2022 by sex and cancer type are shown in Table 1. In total, it is expected that there will be approximately 4,820,000 and 2,370,000 people newly diagnosed with cancer, and 3,210,000 and 640,000 people dying from cancer in China and the USA, respectively.

Estimates suggest that the leading five cancer types diagnosed in 2022 will be cancers of the lung, colorectum, stomach, liver, and breast in China, and cancers of the breast, lung, prostate, colorectum, and melanoma of skin in the USA. The leading five causes of cancer death will be cancers of the lung, liver, stomach, esophagus, and colorectum in China, and cancers of the lung, colorectum, pancreas, breast, and prostate in the USA [Table 1]. The most common cancers diagnosed in males will be lung cancer in China and prostate cancer in the USA. Breast cancer will be the most common cancer in females in both
Trends in cancer incidence and mortality

Long-term trends in incidence and mortality rates of 10 major cancer types are shown in Figure 1. Among male population, the incidence and mortality rates of lung and colorectal cancer in the USA, and of stomach, liver, and esophageal cancer in China have decreased gradually in recent years. However, the incidence rates for the other seven most common cancer types in Chinese women have all increased since 2000. Noticeably, the incidence rate of thyroid cancer has sharply increased since 2000 in both China and the USA, although the mortality rates were very stable during the same period [Figure 1].

Determinants of cancer deaths

The incremental deaths between 1991 and 2019 were expressed by four determinant factors, using cancer deaths estimated by GLOBOCAN 2020 and the WHO for World Population Prospects (2019 revision). Among male population, the incidence and mortality rates of lung and colorectal cancer in the USA, and of stomach, liver, and esophageal cancer in China have decreased gradually in recent years. However, the rates contributed to increased cancer deaths. However, the rates since decreased almost continuously.

Among female population, the incidence and mortality rates of lung and colorectal cancer in the USA, and of stomach, liver, and esophageal cancer in China have decreased gradually in recent years. However, the rates since decreased almost continuously.

Table 1: Estimated new cancer cases and deaths by sex in China and the United States, 2022.∗

| ICD-10 | Cancer site | Total | Male | Female | Total | Male | Female | Total | Male | Female | Total | Male | Female |
|--------|-------------|-------|------|--------|-------|------|--------|-------|------|--------|-------|------|--------|
| C00-97 | All sites   | 3,208,516 | 1,943,763 | 1,264,753 | 440,724 | 338,601 | 102,123 |       |       |       |       |       |       |
| C00-97 | All sites excluding but C44 nonmelanoma skin cancer | 4,796,996 | 2,612,375 | 2,184,621 | 925,496 | 892,375 | 33,174 |       |       |       |       |       |       |
| C00-06 | Lip, oral cavity | 31,733 | 19,484 | 12,249 | 25,210 | 16,914 | 8296 |       |       |       |       |       |       |
| C07-08 | Salivary glands | 9165 | 5078 | 4087 | 5109 | 3033 | 2076 |       |       |       |       |       |       |
| C09-10 | Oropharynx | 5875 | 4575 | 1300 | 13,019 | 10,699 | 2321 |       |       |       |       |       |       |
| C11 | Nasopharynx | 64,165 | 35,227 | 28,938 | 16,914 | 15,323 | 1591 |       |       |       |       |       |       |
| C12-13 | Hypopharynx | 6574 | 6079 | 495 | 214 | 182 | 22 |       |       |       |       |       |       |
| C13 | Oesophagus | 346,633 | 237,543 | 109,090 | 19,042 | 14,977 | 4067 |       |       |       |       |       |       |
| C16 | Stomach | 509,421 | 352,955 | 156,466 | 27,294 | 16,612 | 10,682 |       |       |       |       |       |       |
| C18-20 | Colorectum | 592,232 | 304,257 | 251,975 | 160,248 | 84,579 | 75,669 |       |       |       |       |       |       |
| C22 | Liver | 341,838 | 317,969 | 134,404 | 43,732 | 30,712 | 13,020 |       |       |       |       |       |       |
| C23 | Gallbladder | 31,114 | 11,876 | 19,238 | 4874 | 1705 | 3169 |       |       |       |       |       |       |
| C25 | Pancreas | 134,374 | 75,178 | 59,196 | 131,203 | 72,680 | 58,523 |       |       |       |       |       |       |
| C26 | Lung | 259,827 | 124,002 | 131,825 | 61,579 | 58,30 | 11,279 |       |       |       |       |       |       |
| C31 | Melanoma of skin | 429,105 | 259,827 | 124,002 | 61,579 | 58,30 | 11,279 |       |       |       |       |       |       |
| C41 | Nonmelanoma skin | 346,633 | 237,543 | 109,090 | 19,042 | 14,977 | 4067 |       |       |       |       |       |       |
| C45 | Mesothelioma | 3381 | 1904 | 1477 | 3601 | 2677 | 924 |       |       |       |       |       |       |
| C46 | Kaposi sarcoma | 282 | 154 | 128 | 1107 | 6317 | 1496 |       |       |       |       |       |       |
| C50 | Breast | 429,105 | 259,827 | 124,002 | 61,579 | 58,30 | 11,279 |       |       |       |       |       |       |
| C52 | Larynx | 80,982 | 573,302 | 259,680 | 238,032 | 31,953 | 16,079 |       |       |       |       |       |       |
| C53 | Cervix uteri | 111,820 | 13,740 | 61,579 | 17,543 | 15,259 | 9950 |       |       |       |       |       |       |
| C54 | Corpus uteri | 84,520 | 63,246 | 24,274 | 17,543 | 15,259 | 9950 |       |       |       |       |       |       |
| C56 | Ovary | 57,090 | 57,090 | 24,494 | 39,306 | 39,306 | 14,914 |       |       |       |       |       |       |
| C60 | Penis | 4882 | 4882 | 1538 | 1538 |       |       | 1678 | 1678 | 435 | 435 |       |       |
| C61 | Prostate | 125,646 | 75,178 | 50,196 | 321,953 | 161,079 | 60,874 |       |       |       |       |       |       |
| C62 | Testis | 4509 | 4509 | 900 | 900 | 457 | 457 |       |       |       |       |       |       |
| C63 | Kidney | 77,410 | 77,410 | 77,410 | 77,410 | 77,410 | 77,410 |       |       |       |       |       |       |
| C67 | Bladder | 91,893 | 71,002 | 20,891 | 84,825 | 65,181 | 19,644 |       |       |       |       |       |       |
| C70-72 | Brain, central nervous system | 82,673 | 42,474 | 40,199 | 25,177 | 14,136 | 11,041 |       |       |       |       |       |       |
| C73 | Thyroid | 224,023 | 54,232 | 169,771 | 53,815 | 43,194 | 10,621 |       |       |       |       |       |       |
| C81-82 | Non-Hodgkin lymphoma | 97,788 | 52,767 | 45,021 | 76,510 | 42,426 | 34,084 |       |       |       |       |       |       |
| C89 | Multiple myeloma | 22,450 | 12,989 | 9461 | 18,899 | 14,564 | 4315 |       |       |       |       |       |       |
| C91-95 | Leukaemia | 88,249 | 50,213 | 38,036 | 63,469 | 37,028 | 26,441 |       |       |       |       |       |       |

1 Estimates based on data released by the International Agency for Research on Cancer for GLOBOCAN 2020 and the WHO for World Population Prospects (2019 revision). 2 Including Chinese mainland, Hong Kong, and Macau. Taiwan province was not included because of lack of data in GLOBOCAN 2020. 3 USA dependencies were not included. 4 New cases exclude basal cell carcinoma, whereas deaths include all types of nonmelanoma skin cancer. ICD: International Classification of Diseases.
Figure 1: Trends in cancer incidence and mortality rates by sex for China and the United States of America. Analyses were based on data released by the USA Surveillance, Epidemiology, and End Results program and the China National Cancer Center. Rates for USA cancer incidence (1975–2018) and mortality (1975–2019) were standardized by 2000 USA standard population. Rates for cancer incidence and mortality in China (2000–2015) were standardized by Segi’s world standard population. CNS: Central nervous system.
rate was much lower than that associated with population size and population aging, and the gaps were rapidly widening. Case-fatality rates contributed to reduced cancer deaths in both countries, with a more dramatic contribution in China in recent years than in the USA.

Discussion

In this comparative study, we reported estimated cancer statistics and profiles for 2022, long-term trends in cancer incidence and mortality rates, and determinant factors for incremental cancer deaths in China and USA. Lung cancer is expected to be the most common cancer in China and the leading cause of cancer death in both countries, with breast cancer the most common cancer in the USA in 2022. With the decreases in incidence and mortality rates for cancers of the stomach, liver, and esophagus, and increases in rates for cancers of the lung, colorectum, breast, and prostate, China’s cancer profile is becoming similar to that of the USA. Increases in adult population size and population aging were major determinants of incremental cancer deaths. Some achievements in cancer prevention in the USA may inform the development of cancer control strategies in China.

The estimated cancer cases and deaths in the USA in our study were higher than projections reported by the American Cancer Society (ACS). Cancer statistics in 2022 published by ACS projected 1,918,030 new cancer cases and 609,360 cancer deaths in the USA, giving a gap of about 454,000 cancer cases and 31,000 cancer deaths between the two estimates. Similar differences were observed in reports of cancer statistics in 2020 and GLOBOCAN 2020, resulting in approximately 475,068 cancer cases and 5870 cancer deaths fewer than estimates in the USA in 2020. The gaps between our estimates based on GLOBOCAN 2020 and cancer statistics published by ACS may be explained by the different measurements of non-melanoma cancer of the skin. We included non-melanomas of the skin in total cancer cases and deaths [Table 1], but the ACS did not. Population aging is likely to be a major social characteristic in China for the foreseeable future. China has one of the fastest growing aging populations in the world. By the end of 2020, the population in China aged 60 years and older was 260 million, with an annual increase of approximately 10 million expected from 2021 to 2025. The total population size in China is expected to reach a peak around 2025, and the proportion of those aged 60 years and older is expected to exceed 30% by 2035. If population size remains stable or decreases, but population aging continues to increase, the upward trend in cancer burden is likely to
remain unchanged in China. Healthy aging strategies would therefore need to be included in cancer prevention activities and multisectoral collaboration should be enhanced in policy development.221

China is undergoing a transition toward the cancer profiles in developed counties, characterized by high incidence of cancers of the lung, colorectum, breast, and prostate.222 These changes are a move toward mass cancer screening and early detection for the eligible population aged 45 to 74 years old.223 Several screening technologies and strategies have been developed to reduce the cancer burden in the USA, and might be introduced into cancer screening services in China.224 Screening should target the high-risk population and cancers, such as colorectal, breast, lung, cervical, and upper gastrointestinal cancer.224 Considering the large population, potential benefits and harms from screening, and the capacity of health services, China would probably not provide a “one size fits all” cancer screening service across each province and county.10 Providing organized screening for high-risk areas and opportunistic screening for non-high-risk areas might be the most feasible solution in the near future.

Approximately 45.2% cancer deaths in China in adults aged 20 years or older were attributable to 23 modifiable risk factors.225 Primary cancer prevention that is focused on controlling behavioral, dietary, metabolic and environmental factors, and infectious agents has great potential to reduce the burden of cancer in China. Compared with the USA, where smoking prevalence gradually decreased from 25% in 1997 to 15% in 2015, Chinese adults have a higher smoking prevalence (25.2% in 2013) and this is not changing.26,27 Consequently, approximately 16.8% of all cancer deaths in adults 30 years and older in China were attributable to active and second-hand smoking, and more than 98% of these deaths in men were attributable to active smoking compared with 50% in women.228 The tobacco epidemic remains at an earlier stage in China than in the USA, and the full impact of tobacco smoking patterns in recent decades on cancer mortality may therefore not yet have been realized.229 If no tobacco control action is taken to immediately reduce tobacco use with implementation of targeted policies and programs, the burden of cancer will continue to grow dramatically. Comprehensive smoke-free policies should be adopted across China, instead of being largely limited to particular metropolitan areas.228

Cervical cancer is expected to be eliminated as a public health problem worldwide for the first time.30 However, incidence and mortality rates of cervical cancer in China have increased significantly since 2000. Only if China adopts a comprehensive strategy, including human papillomavirus vaccination, cervical screening, and treatment of pre-invasive lesions and invasive cancer, then cervical cancer could be eliminated by the late 2040s, with potential economic benefits.31

The 5-year relative survival rate in cancer increased from 30.9% in 2003–2005 to 40.5% in 2012–2015 in China.32 However, the survival rates for specific cancer types were lower in China than the USA, especially breast and colorectal cancer.5,32 The data reported in our study also suggest that cancer prognosis in China is poorer than in the USA because the cancer-type-specific mortality to incidence ratios were generally lower in China. More efforts are needed in China to deliver effective cancer care and improve universal health coverage.133

Our study had several limitations. First, the estimates of cancer burden in 2022 were subject to biases within the GLOBOCAN 2020 reporting system.121 Second, we used cancer rates in 2020 as an approximation of rates in 2022, which did not account for any potential changes from 2020 to 2022. Third, the data from GBD 2019 depended on the out-of-sample predictive validity of modeling work, particularly where data were not available.34 Lastly, we adopted two distinct standard populations in calculating age-standardized incidence and mortality rates because long-term age-specific cancer cases, deaths and populations were not reported.5,10

In summary, there was a dramatic increase in incidence and mortality rates in cancers of the colorectum, female breast, and male prostate in China. However, rates of cancers of the stomach, liver, and esophagus decreased gradually. This produced a narrowing disparity between cancer profiles in China and the USA. Given the increasing contributions of population aging on the incremental cancer burden, China may benefit from adopting some of the effective prevention measures from USA, as well as actions to support healthy aging.

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Conflicts of interest
None.

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