ATLAS OF CANCER MORTALITY IN THE PEOPLE'S REPUBLIC OF CHINA

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EDITED BY
THE EDITORIAL COMMITTEE FOR THE ATLAS OF CANCER MORTALITY
IN THE PEOPLE'S REPUBLIC OF CHINA

PUBLISHED BY CHINA MAP PRESS First Edition 1979

中华人民共和国恶性肿瘤地图集 (英文版)

中华人民共和国恶性肿瘤地图集编辑委员会编制 中华地图学社出版 上海延安西路 1538 号 上海中华印刷厂印刷

统一书号: 12178.029 1979年12月第1版

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本图上中国国界线系按照地图出版社 1971 年出版的 《中华人民共和国地图》绘制。

行政区划资料截止期 1976年 12月

China Map Press No. 1538, Yan'an Xilu, Shanghai, China.

Printed in the People's Republic of China

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FOREWORD

A survey has been completed showing the mortality patterns of the more common cancers in the People's Republic of China. The study was conducted in accordance with the directive from our late Premier Zhou En-lai to keep abreast of the occurrence and distribution patterns of cancer in our country. Epidemiologists, biostatisticians and approximately one million medical workers obtained relatively complete and reliable data on the cause of death over a three year period from a population of 800 million persons residing in the 29 provinces (not including Taiwan), municipalities, and autonomous regions of China. As a result of this investigation, national cancer mortality distribution patterns have been clarified. This work was conducted under the direct leadership of the Party Committees, having overcome the recent disruption of the Gang of Four.

Under the auspices of the Ministry of Health and Chinese Academy of Sciences, the preparation and publication of the Atlas of the Cancer Mortality in the People's Republic of China was organized and sponsored by the National Cancer Control Office of the Ministry of Health and the Fifth Bureau of the Chinese Academy of Sciences as well as by related colleges or universities and institutions.

The atlas shows the geographic variation of cancer mortality rates within China. The information can be used to help research departments develop programs for cancer etiology and prevention, and medical and public health education. For the reader's convenience, a series of statistics has been provided with each map. Also included are maps of the administrative units: population, nationalities, topography, climate and soil.

This is the first edition of the Atlas of Cancer Mortality in the PRC, and hence there may be shortcomings or errors in its contents. Suggestions and advice for future editions would be appreciated.

Editorial Committee for the Atlas of Cancer Mortality in the People's Republic of China

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ACKNOWLEDGMENTS

We are grateful for the assistance of Dr. Frederick P. Li of Clinical Epidemiology Branch, National Cancer Institute of the USA, Dr. Elaine L. Shiang of Department of Medicine of Peter Bent Brigham Hospital, Boston, Mass., Professor Walter Davis, Head of Research Training and Liaison Programme and Professor Calum S. Muir, Head of Department of Epidemiology and Biostatistics, International Agency for Research on Cancer in translating and proof-reading this English Edition that resulted in early publication of this Atlas.

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EXPLANATORY NOTES

1. SOURCE OF DATA

The data used in preparation of this atlas came from the nation-wide cancer mortality survey organized by the National Cancer Control Office of the Ministry of Health. Using a retrospective survey method, leaders, masses together with professional personnel, were able to complete an ad hoc investigation of cancer mortality patterns for the years 1973-1975. With the help of local representatives, the survey extended into the rural production brigades and town neighborhood, examining cancer mortality patterns for a population of approximately eight hundred million people.

The survey took about three years to complete and was carried out under the leadership of the Party Committees at various administrative levels.

In order to assure accuracy and completeness, a manual of instruction called "Methods for the Investigation of Patterns of Cancer Mortality" and several uniform questionaires, were published by the National Cancer Control Office of the Ministry of Health, and corresponding survey technical advisory group was organized in the whole country, including in each province, prefecture and county. These advisory groups distributed uniform questionnaires and provided on-the-spot guidance, checked the quality of data at each administrative level and controled the maintenance of standards. Survey data collected were checked, verified and transmitted to the respective higher technical advisory group.

Finally, the National Survey Technical Advisory Group centralized the data for statistical analysis.

COMPLETENESS AND RELIABILITY OF DATA

2.1. Scope of survey

Over 96.7% of the 30 provinces (not including Taiwan), municipalities and autonomous regions were surveyed, covering most of the permanent residents of the county administrative units. There were altogether 35 counties not surveyed, a) 3 counties of the A Ba Autonomous Prefecture, 13 counties of the Gan Zi Autonomous Prefecture and 4 counties of the Liang Shan Autonomous Prefecture of Sichuan province, b) 7 counties of Na Qu prefecture and 7 counties of A Li prefecture of the Xizang Autonomous Region, c) 1 county in Qinghai province. Among them only A Li Prefecture of the Xizang Autonomous Region as a whole was not surveyed.

2.2. Basis of Diagnosis

The affiliated table presents the level of the hospital or clinic where the diagnosis of cancer was made. Among all cancer deaths 92. 54% were diagnosed at or above the level of commune hospital; 79.15% were diagnosed at or above the county hospital level. Methods used in antemortem diagnosis were divided into 4 levels:

- level I. Diagnosis was made by pathological or cytological examination of tissue specimens, including bone marrow (16.66% of all deaths).
- level II. Diagnosis was made by X-ray, ultrasound, isotope scans, endoscopy, exploratory laparotomy (without biopsy), immunological markers or chemical laboratory tests (53.84% of all deaths);
- level III. Diagnosis was based on clinical examination alone. It covered 23.46%
- level IV. Diagnosis was based on histories of symptoms and signs given by relatives or others after patient's death or the diagnosis may be doubtful. It was 6.04% of all deaths.

Thus, 70.5% of deaths had an antemortem diagnosis made at level I or level II.

2.3. Trends of Cancer Mortality

Cancer distribution map shows that the trends of cancer mortality in neighbouring regions between provinces were not influenced by the man-made boundaries of administrative units, organizations of the survey, or differences in diagnosis and treatment.

2.4. Result of checking up

In the course of scrutinizing survey material, the survey technical advisory groups made spot checks on a portion of the regional data. Results of these checks showed that mistakes in diagnosis and missing cases were both approximately 5%. In addition, registry data of cancer mortality obtained from over 30 existing national field stations was consistent with the results obtained from this retrospective investigation.

During screening survey methods used such as esophageal cytology screening by a balloon technique for esophageal cancer, alpha-fetoprotein assay for liver cancer, Papanicolaous for cervical cancer, or nasopharyngeal mucous membrane biopsy for nasopharyngeal cancer showed that the distribution trend of detection rates was similar to that of the mortality rates in cancers with high mortality; thereby again confirming the reliability and completeness of data.

3. RANKING OF DATA

Two statistical methods were used in the preparation of cancer distribution maps to present the data and to facilitate comparison. The mortality rates were age-adjusted to the 1964 census population of China.

3.1. Ranking on a Geometric Scale

Age-adjusted mortality rate for each cancer was calculated by city, county and prefecture and was then grouped into one of the 6 grades in geometric scale.

PERCENTAGE OF HOSPITAL OR CLINIC AND DIAGNOSIS LEVEL OF PATIENTS WHO DIED OF MALIGNANT NEOPLASMS

			Hospi	Hospital or clinic level	level				I	Diagnosis level	le	
Classification	Untreated	Production	Commune	County	Prefecture	Province	Total	I	п	ш	VI	Total
Nasopharynx	2.00	2.88	8.28	20.29	21.00	44.65	100	39.87	27.72	26.60	5.81	100
Esophagus	2.77	6.34	16.90	37.02	22.89	14.08	100	9.78	65.31	19,64	5.27	100
Stomach	3.42	5.65	15.70	35.67	24.04	15.52	100	8.79	60.81	23.07	7.33	100
Liver	1.43	2.85	11.18	33.13	28.84	22.57	100	9.35	59.11	27.31	4.23	100
Rectum	4.04	4.99	13.54	30.47	25,23	21.73	100	18.09	43.66	29.73	8.52	100
Lung	1.21	1.94	7.84	28.61	31.88	28.52	100	11.38	75.46	10.08	3.08	100
Breast	2.03	3.71	10.71	27.67	28.81	27.07	100	35.95	28.32	31.30	4.43	100
Cervix uteri	4.31	5.04	14.84	29.47	24.28	22.06	100	32.56	25.98	33.36	8.10	100
Leukemia	0.87	1.09	6.11	32.63	33.73	25.57	100	66.15	0.00	31.28	2.57	100
Colon	4.10	5.92	13.61	32.35	27.04	16.98	100	13.60	48.62	28.52	9.26	100
Bladder	5.11	5.57	13.11	25.14	28.07	23.00	100	15.99	40.64	32.52	10.85	100
Penis	5.76	6.10	15.02	29.33	24.69	19.10	100	25.18	22.53	42.51	9.78	100
Malignant Lymphoma	2.56	3.74	9.92	23.47	29.89	31.42	100	44.47	23.56	25.99	5.98	100
Choriocarcinoma	3.32	2.01	8.94	30.61	27.59	27.53	100	36.91	30.94	25.33	6.82	100
Brain Tumor	3,16	2.99	7.39	18.28	26.87	41.31	100	16.89	48.23	26.98	7.90	100
Other	3.67	4.26	10.36	24.11	28.65	28.95	100	29.95	34.91	27.56	7.58	100
Total	2.79	4.67	13.38	32.49	25.99	20.68	100	16.66	53.84	23.46	6.04	100

3.2. Ranking in Relation to National Rate

Age-adjusted mortality rate for each cancer was calculated by city, county and prefecture and compared with the age-adjusted mortality rate for the whole country. Differences in mortalities were tested on significant tests and grouped into one of the five grades described below.

Grade 1. Age-adjusted mortality rates lay within the highest decile, difference to national rate significant.

Grade 2. Age-adjusted mortality rate lay not within the highest decile, higher than national rate, difference significant.

Grade 3. Age-adjusted mortality rates lay within the highest decile, but difference to national rate non-significant.

Grade 4. Age-adjusted mortality rates with difference to national rate non-significant.

Grade 5. Age-adjusted mortality rates lower than national rate, difference significant.

4. CONTENTS OF ATLAS

4.1. Introductory Maps

These maps show the administrative units (p.1), population (p.3), nationalities (p.5) topography (p. 7), climate (p. 9), and soil (p. 11) of China. They may be used for reference when studying the special characteristics of the geographic distribution of cancer.

4.2. Cancer Distribution Maps

There are two maps of the city, county and prefectural administrative units (p. 13 and p. 87 respectively) which may be used to locate the name of city or prefecture. The 46 individual cancer maps (p. 15-86) are arranged in order of frequency, starting with the cancer with the highest mortality rate. Age-adjusted mortality rates were calculated by county for nine common cancers including stomach, esophagus, liver, cervix uteri, lung, colon and rectum, leukemia, breast and nasopharynx, as well as all malignant neoplasms. In those areas where the population was too small by county, as in Xizang Autonomous Region, Qinghai province and some parts of Sichuan province, age-adjusted mortality rates were calculated by prefecture. For those cancers of low incidence including brain tumour, malignant lymphoma, bladder, penis, and choriocarcinoma, age-adjusted mortality rates were also calculated by prefecture. In the three provinces of Guangdong, Shandong, Gansu and Guangxi Zhuang Aut. Rgn., cancers of low incidence were not separated from the other cancers and were subsequently not included in the maps for these sites (p. 88-95).

4.3. Relative Frequency of the Age-Adjusted Mortality Rates of Malignant Neoplasms by Site

These maps portray the total death rate for all malignant neoplasms and the percentage of rate for each cancer by site in each province, municipality and autonomous region (p. 96-99).

4.4. Tables and Figures

Related tables and figures are provided with each cancer map.

- a) Age-adjusted mortality rates by province, municipality and autonomous region;
- b) Distribution of counties according to age-adjusted mortality rates;
- c) Percentile ranking of counties according to magnitude of age-adjusted mortality rates;
- d) Number of counties by grading on age-adjusted mortality rates in relation to national rate;
- e) Age-adjusted mortality rates and relative frequency of malignant neoplasms;
- f) Relative frequency of malignant neoplasms by age-group and site;
- g) Age-specific mortality rates and curves by sex;
- h) Relative frequency and ranking of malignant neoplasms by site by province, municipality and autonomous region.

5. LEADING CAUSES OF DEATH AND AN IMPORTANT PROBLEM OF PUBLIC HEALTH

The national average annual age-adjusted cancer mortality rate for males was 80.17/100,000, for females 54.27/100,000. The proportionate mortality rate from cancer was 11.31% for males and 8.85% for females. During the 1973-1975 period, cancer was the second leading cause of death for males, following respiratory diseases, and the third for females following respiratory and heart diseases other than coronary heart disease and cerebrovas-cular diseases. The burden of cancer varies with age: among males aged 0-14, cancer was the cause of 0.88% of all deaths and ranked the ninth cause. Among males aged 15-34, cancer comprises 8.72% of all deaths, and was the 2nd leading cause of death. In the age group of 35-54 and 55-74, cancer accounted for 23.05% and 17.58% respectively, and was the leading cause of death for both groups. Females showed similar trends, indicating that not only was cancer a very important cause of death for the total population but also that it severely affected the young and working population.

Among the 29 provinces, municipalities and autonomous regions, the highest cancer mortality rates for males were found in Shanghai, Jiangsu, Fujian, Ningxia and Zhejiang. And the highest cancer mortality rates for females were found in Jiangsu, Shanxi, Shanghai and Fujian. In one municipality (Shanghai) and in the three provinces of Jiangsu, Fujian and Zhejiang, cancer was the leading cause of death in males, and in Jiangsu, in females. In eight provinces, municipalities or autonomous regions cancer ranked second among all causes of death for males, and in four for females. Cancer was the third cause of death, both for males and females, each in five areas. Shanghai had the highest mortality due to cancer, with an age-adjusted rate of 133.22/100,000 for males and 70.74/100,000 for females, comprising 27.42% and 19.36% of all deaths respectively. The cumulative mortality rates in Shanghai for males was 25.8%, for females 13.2%. Applying these rates to the present population of Shanghai of ten million, nearly one-fifth or 2 million people will probably die of cancer.

Cancer was the leading cause of death for males in 60 prefectures or cities comparable to prefectural level and the second cause of death in another 38 prefectures or cities comparable to prefectual level. For females, cancer was the leading cause of death in 21 prefectures or cities comparable to prefectural level and the second cause of death in another 25 prefectures or cities comparable to prefectural level. Amongst these areas, Fuzhou had the highest age-adjusted mortality rates, 191.63/100,000 for males and 121.21/100,000 for females. Cancer deaths comprised 31.14% (male) and 21.55% (female) of all deaths with cumulative mortality rates of 27.9% (male) and 14.8% (female).

At the county level or comparable county administrative level, cancer was the leading cause of death for males in 429 counties and second cause of death in 259 counties. For females cancer was the leading cause of death in 161 counties and the second in 202 counties. Yangzhong county of Jiangsu province, had the highest age-adjusted mortality rates of 279.3/100,000 for males, and 187.3/100,000 for females, that is 35.33% (male) and 34.50% (female) of all deaths. In another words, one out of three people in this county died of cancer yearly.

From the above data, it was evident that cancer was an important and common threat to the health of the people, with adverse effects on the socialist revolution and reconstruction. Improved living conditions, control of infectious and epidemic diseases, and extension of life expectancy for the population have come about as a result of socialist development. Thus, amongst problems encountered during the "New Long March", cancer will become even more prominent. Therefore serious attention must be paid to the prevention, control of this disease, and to all aspects of cancer research.

6. DISTRIBUTION OF CANCER

6.1. Site Distribution

In males, deaths due to stomach cancer were the most frequent, with average mortality rate of 20.93/100,000, comprising 26.11% of all cancers. Next in frequency were esophagus, liver, lung, and colon and rectum cancer. In females, deaths due to stomach also ranked first, followed by cervix uteri, esophagus, liver, and lung cancer. The frequency of cancer by site varies with age. In children (age 0-14) leukemia was the most common neoplasm, comprising 52.42% for males and 53.60% for females. Following leukemia were brain tumors with 10.43% for males and 10.04% for females and malignant lymphoma with 6.36% for males and 5.00% for females. Among young people aged 15-34, the most common neoplasm was liver cancer, comprising 24.48% for males and 11.22% for females, followed by leukemia with 20.74% for males and 21.03% for females. In middle age (35-54) and above age 55 the principal cancers are stomach, esophagus, cervix, liver and lung. The knowledge of the variation in cancer frequency is of necessity to those regions and departments in the decision making related to cancer prevention and cancer research.

6.2. Age Distribution

The age distribution curve of each cancer had distinctive features that permited the separation of the cancers into different groups. In the first group, represented by esophagus, stomach, lung, colon and rectum, bladder, and penis cancer, mortality increased with age, indicating that exogenous factors played a dominant role in carcinogenesis of these cancers. The second group was represented by cancer of the cervix which was most common in middle age, the mortality declining thereafter. This suggested that etiologic factors played a role in the younger years, not so much in later years, perhaps because of changes in the physiology of the host such as menopause or decreased host susceptibility. The third group was represented by breast cancer which rose rapidly in mortality since early adulthood until around the age of 45 and continued to rise slowly thereafter. This pattern suggested different stimuli at varying ages, possibly a result of changing endocrine function. The fourth category included liver cancer and nasopharyngeal cancer where deaths were most frequent in young adults. The curves leveled out thereafter but remain high, suggesting exposure to etiologic agents in early life which level out in middle years, or a possibility that susceptibility is decreased in later years. The fifth category was represented by leukemia which had a peak in childhood thereafter gradually decreasing in frequency, without much variation with age. This suggested a susceptibility factor associated with the childhood years. The sixth pattern, as represented by choriocarcinoma showed development of the disease during the child-bearing years, indicating the relation to the reproductive process. Thus, careful analysis of various patterns of age distribution of cancer could be of value in providing clues for cancer etiology research.

6.3. Regional Distribution

The results of data analysis show clearly that cancer varied substantially from region to region. The East, the North and Northwest China had higher cancer rates while the South, Southwest, and Northeast had lower rates. Moreover, each cancer has its particular distribution. For example, some cancers show a broad nationwide distribution while others show marked regional variation. The regional distribution characteristics of the more common cancers in China are given below.

- a) All Malignant Neoplasms
 - In East China, cancer deaths are higher in Shanghai, Jiangsu, Fujian, Zhejiang; in North China, in Henan, Shanxi and Hebei; and in Northwest China, in Ningxia and Qinghai. Cancer deaths are lower in provinces of Yunnan, Guazhou and Hunan. Shaanxi and Inner Mongolia had distinctly high rates, probably due to very high rates for cervical cancer.
- b) Nasopharyngeal Cancer
 This cancer presented a very distinctive distribution pattern. It was concentrated in the south of Guangdong,
 Hunan, Fujian, Jiangxi provinces and Guangxi Zhuang Aut. Rgn.. Mortality rates gradually declined, going northward.

c) Esophageal Cancer

The principal areas of high mortality included (1) three adjoining provinces of North China: Henan, Hebei and Shanxi; (2) northern regions of Sichuan province; (3) Dabie mountainous area of Hubei and Anhui provinces; (4) southern region of Fujian province and the northeast region of Guangdong province; (5) north region of Jiangsu province; (6) the Hasake region of Xinjiang Uygur Aut. Rgn.. Around the majority of highmortality areas, concentric but irregular areas of decreasing Mortality were found. Thus, the distance between high and low mortality areas was not long.

d) Stomach Cancer

High mortality areas were concentrated in the northwest and coastal regions, especially in Gansu and Qinghai provinces and Ningxia Hui Aut. Rgn., Shanghai, Jiangsu, Zhejiang and Fujian. The peninsulas of Liaodong and Shandong also show high rates.

e) Liver Cancer

High mortality areas were concentrated along the southeast coast, particularly Shanghai, Guangxi Zhuang Aut. Rgn. and Fujian, Jiangsu, Zhejiang, and Guangdong provinces. Nationally, the Fusui County of Guangxi Zhuang Aut. Rgn. and the Qidong county of Jiangsu province stood out with the highest liver cancer mortality in the whole country.

f) Lung Cancer

Urban areas showed higher rates than rural areas. The three municipalities of Beijing, Tianjin and Shanghai, Liaoning and Jilin provinces in the Northeast China and Hebei in North China were the highest mortality areas. Next came Heilongjiang province, Inner Mongolia Autonomous Region, Shanxi and the coastal areas of Shandong, Jiangsu, Zhejiang and Fujian provinces. In order to determine whether or not the rates were related to industrialization, it was important to note the distinctive patterns.

g) Cervix Uteri Cancer

The high mortality areas included Shanxi, Inner Mongolia, Shaanxi, Hubei, Jiangxi, with particularly high rates in west Hubei, south Shaanxi, southeast Shanxi, and the adjoining areas of Hunan and Jiangxi.

h) Colon and Rectum Cancer

The principal areas with high mortality were concentrated in Jiangsu and Zhejiang, near the delta region of the Changjiang River. Northeast and North China, also had high rates, but there was no geographic pattern that appeared with regularity.

i) Breast Cancer

Female breast cancer showed a scattered distribution, without evidence of high mortality areas.

j) Leukemia

With the exception of some high mortality counties in Jiangsu and Zhejiang, leukemia also showed a scattered distribution.

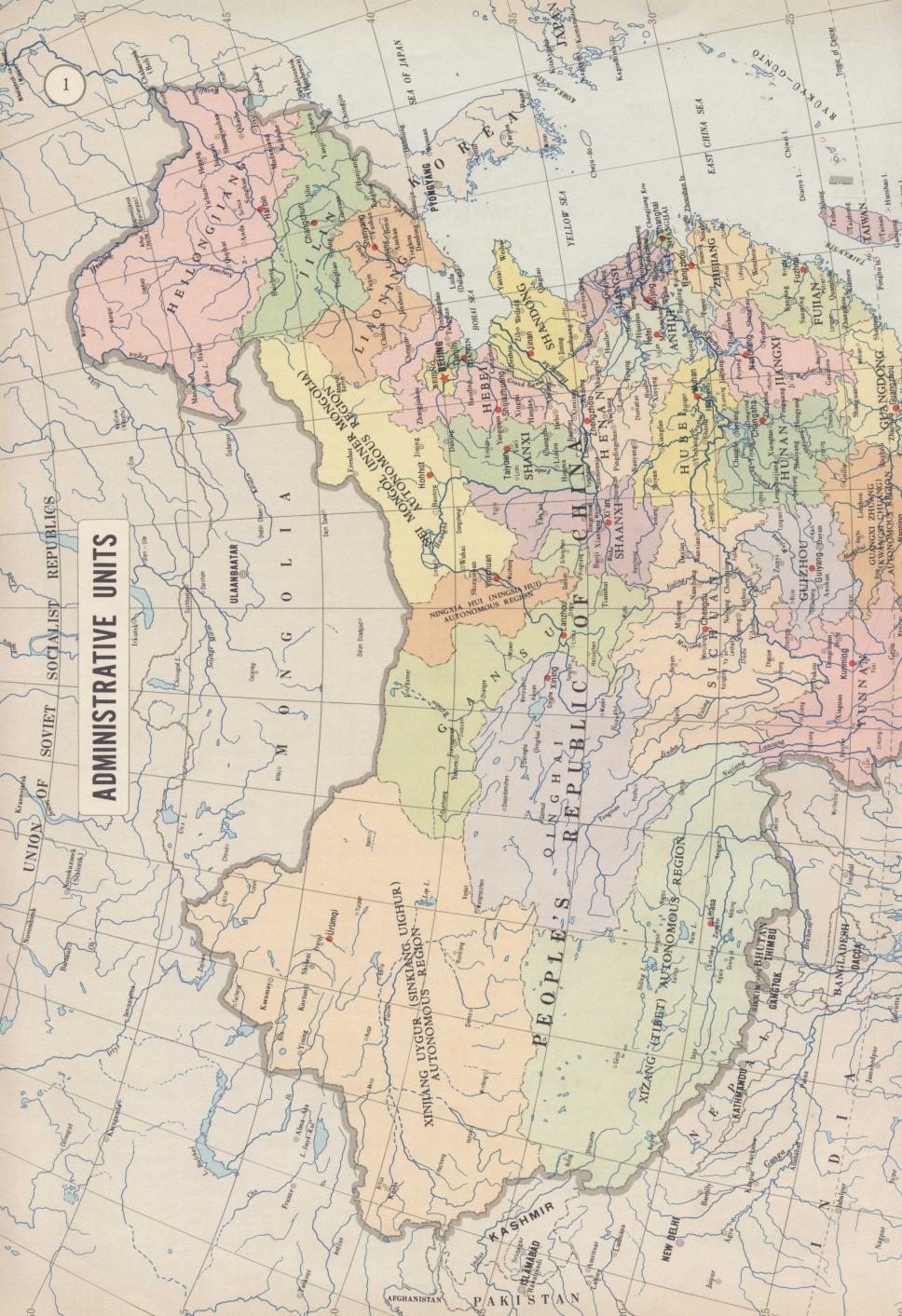
It was evident that each cancer had its own distribution pattern. In China, the land mass is vast and the population enormous. There are great differences in natural environments, and a wide diversity ways of living and local customs. The maps and tables of this atlas provide a resource useful as a first step in the study of cancer causation. Geographic patterns and associations may suggest risk factors and places where further epidemiologic and therapeutic studies should be concentrated.

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