

Original Article

Nasopharyngeal carcinoma incidence and mortality in China in 2009

Zhi-Jian Xu¹, Rong-Shou Zheng², Si-Wei Zhang², Xiao-Nong Zou² and Wan-Qing Chen²**Abstract**

Nasopharyngeal carcinoma (NPC) is rare globally but common in China and exhibits a distinct ethnic and geographic distribution. In 2009, the National Central Cancer Registry in China provided real-time surveillance information on NPC. Individual NPC cases were retrieved from the national database based on the ICD-10 topography code C11. The crude incidence and mortality of NPC were calculated by sex and location (urban/rural). China's population in 1982 and Segi's world population structures were used to determine age-standardized rates. In regions covered by the cancer registries in 2009, the crude incidence of NPC was 3.61/100,000 (5.08/100,000 in males and 2.10/100,000 in females; 4.19/100,000 in urban areas and 2.42/100,000 in rural areas). Age-standardized incidences by Chinese population (ASIC) and Segi's world population (ASIW) were 2.05/100,000 and 2.54/100,000, respectively. The crude mortality of NPC was 1.99/100,000 (2.82/100,000 in males and 1.14/100,000 in females; 2.30/100,000 in urban areas and 1.37/100,000 in rural areas). The age-standardized mortalities by Chinese population (ASMC) and world population (ASMW) were 1.04/100,000 and 1.35/100,000, respectively. The incidence and mortality of NPC were higher in males than in females and higher in urban areas than in rural areas. Both age-specific incidence and mortality were relatively low in persons younger than 30 years old, but these rates dramatically increased. Incidence peaked in the 60–64 age group and mortality peaked in the over 85 age group. Primary and secondary prevention, such as lifestyle changes and early detection, should be carried out in males and females older than 30 years of age.

Key words Nasopharyngeal carcinoma, cancer registry, incidence, mortality, China

Nasopharyngeal carcinoma (NPC) is a rare malignancy in most parts of the world but is particularly frequent in China, especially in the South^[1]. The average incidence of NPC worldwide is less than 1/100,000 population^[2]. However, in endemic areas of China, its incidence reaches 20/100,000^[3–5]. In the past three decades, NPC incidence has declined among the Chinese residing in Southeast Asia, including Taiwan, Hong Kong, and Singapore^[5]—areas with lifestyles distinct from that of mainland China. The National Central Cancer Registry (NCCR) of China, responsible for data collection, evaluation, analysis, and publication from population-based cancer registries, has organized three retrospective mortality surveys on the causes of cancer death, which provide sex- and age-specific mortality for major cancers among areas in mainland China. Recent population-based studies in China show that the incidence of NPC

in some areas has remained stable in males and even slightly decreased in females^[6,7]. Additionally, although rates are still higher in persons over 50 years of age, the age-specific mortality in the high risk age group has followed a downward trend over a 30-year period.

The NCCR of China established the Chinese Cancer Registry annual report system to comprehensively promote cancer registration. The Chinese Cancer Registry Annual Report has been published since 2008 and has provided the scientific basis for cancer prevention and control in China. In 2012, the NCCR collected data for the calendar year 2009 from 104 registries. After comprehensive quality evaluation, data from 72 registries were selected as sources of the annual report to reflect cancer incidence and mortality in the registration areas. In this study, NPC cases were retrieved from the national database for analysis to show the updated NPC burden in Chinese population.

Authors' Affiliations: ¹Cancer Screening Center, Cancer Hospital, Chinese Academy of Medical Sciences, Beijing 100021, P. R. China; ²National Office for Cancer Prevention and Control & National Cancer Center, Beijing 100021, P. R. China.

Corresponding Author: Wan-Qing Chen, National Cancer Center, Beijing 100021, P. R. China. Tel: +86-10-87787039; Fax: +86-10-67718227; Email: chenwq@cicams.ac.cn.

doi: 10.5732/cjc.013.10118

Material and Methods**Data source**

All new cancer cases diagnosed in 2009 were reported to cancer registries from all hospitals, community health centers, and other

institutions, including centers of township medical insurance and the New-type Rural Cooperative Medical System. The death record database was linked and matched with the cancer registration database for identifying cancer deaths and missed cases.

Totally 104 cancer registries (covering 46 cities and 58 counties in 27 provinces) reported cancer registration data to NCCR. The overall population coverage was 109,476,347, accounting for 8.2% of the whole population. The cancer registries coded cancer site and histology according to the International Classification of Diseases for Oncology, third edition (ICD-03) and tenth edition (ICD-10). Invasive cases of NPC (topography code C11) were retrieved and analyzed from the overall cancer database. Demographic information was provided by the National Statistics Bureau.

Quality control

Based on the guideline of Chinese cancer registration^[8] and the standard of data inclusion in Cancer Incidence in Five Continents Volume IX^[9], cancer registration data were evaluated by several quality indicators: proportion of morphologic verification (MV%), percentage of cancer cases identified with death certification only (DCO%), and mortality/incidence ratio (M/I)^[10-12]. The detailed standard for data inclusion was shown previously^[13]. Generally, data with DCO% less than 20%, an overall MV% more than 55%, and M/I between 0.55 and 0.95 were considered acceptable.

Statistical analysis

Crude incidence and mortality of NPC were prepared by sex, area, and 19 total age groups (<1, 1-4, 5-9, ... 80-84, ≥ 85 years). Age-standardized rates were calculated using the Chinese population from 1982 and Segi's World population. The cumulative risk of developing or dying from cancer for persons young than 75 years (in the absence of competing causes of death) was calculated and presented as a percentage. Software including MS-FoxPro, MS-Excel, and IARCcrTools issued by the International Agency for Research on Cancer (IARC) and the International Association of Cancer Registration (IACR) were used for data checkup. SAS software (version 9.0) was used to calculate incidence and mortality.

Results

Pooled data

After evaluating all submitted information, data from 72 population-based cancer registries were accepted for the annual report. The population covered by these cancer registries was 85,470,522, including 43,231,554 males and 42,238,968 females, accounting for 6.4% of the whole population. A total of 31 registries were from urban areas, covering a total population of 57,489,009, whereas 41 registries were from rural areas, covering a total population of 27,981,513. The MV%, DCO%, and M/I for the national pooled data were 71.99%, 3.05%, and 0.55, respectively, in urban

areas and 70.65%, 3.54%, and 0.56, respectively, in rural areas. There were 3,085 new cases of NPC (2,197 males and 888 females) and 1,702 overall NPC cancer deaths (1,219 males and 483 females) in 2009. Detailed information for the covered population, including NPC incidence and deaths in each cancer registry, is shown in **Table 1**.

Incidence

The crude incidence of NPC was 3.61/100,000 in 2009, accounting for 1.26% of all new cancer cases. The age-standardized incidences by Chinese population (ASIC) and world population (ASIW) were 2.05/100,000 and 2.54/100,000, respectively. Among persons under the age of 75, the cumulative incidence was 0.28%.

NPC occurred more frequently among males than females. For males, the crude incidence of NPC was 5.08/100,000, whereas the ASIC and ASIW were 2.89/100,000 and 3.60/100,000, respectively. For females, the crude incidence of NPC was 2.10/100,000, whereas the ASIC and ASIW were 1.21/100,000 and 1.47/100,000, respectively. The crude incidence in urban areas (4.19/100,000) was higher than that in rural areas (2.42/100,000). After age standardization, incidence in urban areas was still higher than that in rural areas (ASIW, 2.88/100,000 vs. 1.80/100,000; **Table 2**).

Age-specific incidence of NPC for both sexes and areas was compared. Overall, the age-specific incidence was relatively low in persons under 30 years old but dramatically increased in those over 30 years old, peaking in the 60-64 age group in males and urban areas, in 80-84 age group in rural areas, and in 70-74 age group in females. For persons over 30 years old, NPC age-specific incidence was more than 2-fold greater in males than in females, although there were slight differences among those under 30 years old. The age-specific incidence of NPC in urban areas was generally higher than that in rural areas both in males and females, especially in older age groups (**Table 3, Figure 1**).

Mortality

The mortality of NPC was higher in males than in females. The crude mortality, the age-standardized mortalities by Chinese population (ASMC) and world population (ASMW) were 2.82/100,000, 1.51/100,000, and 1.97/100,000, respectively, for males and 1.14/100,000, 0.57/100,000, and 0.74/100,000, respectively, for females. These values were 2.30/100,000, 1.15/100,000, and 1.50/100,000, respectively, in urban areas and 1.37/100,000, 0.78/100,000, and 1.00/100,000, respectively, in rural areas. NPC was confirmed to be a fatal disease in both males and females, and in urban and rural areas (**Table 4**).

Age-specific mortality by sex and area is shown in **Table 5** and **Figure 2**. The mortality was relatively low in age groups under 40 years old and peaked in the over 85 year age group. However, in urban females, the mortality in the 75-79 age group was the highest among all groups and in rural males, the 70-74 age group had the highest mortality of NPC. The age-specific mortality of NPC in urban areas was generally higher than that in rural areas in both males and

Table 1. Population and number of new nasopharyngeal carcinoma (NPC) cases and deaths in cancer registries in 2009

Registry	Area ^a	Population			New NPC cases			NPC deaths		
		Both	Males	Females	Both	Males	Females	Both	Males	Females
Beijing	1	7,645,186	3,859,586	3,785,600	81	64	17	76	56	20
Qianxi	2	361,312	182,138	179,174	1	1	0	0	0	0
Shexian	2	394,944	205,168	189,776	2	2	0	2	2	0
Cixian	2	634,333	322,621	311,712	6	5	1	2	2	0
Baoding	1	948,612	478,051	470,561	11	5	6	4	2	2
Yangquan	1	683,165	346,023	337,142	2	2	0	2	1	1
Yangcheng	2	383,165	192,119	191,046	5	3	2	2	0	2
Chifeng	1	1,203,006	613,725	589,281	10	6	4	7	4	3
Shenyang	1	3,497,815	1,722,976	1,774,839	56	41	15	34	19	15
Dalian	1	2,266,224	1,136,772	1,129,452	36	26	10	18	14	4
Zhuanghe	2	915,660	461,826	453,834	15	11	4	5	1	4
An'shan	1	1,471,775	731,916	739,859	22	14	8	14	10	4
Benxi	1	955,409	475,113	480,296	13	11	2	6	5	1
Dandong	1	767,011	378,794	388,217	14	8	6	10	5	5
Donggang	2	640,853	323,798	317,055	22	18	4	3	2	1
Dehui	2	943,395	479,486	463,909	21	17	4	8	5	3
Yanji	2	440,957	215,260	225,697	0	0	0	2	1	1
Daoli District, Harbin	1	713,264	351,071	362,193	12	10	2	6	5	1
Nangang District, Harbin	1	1,020,233	508,921	511,312	13	9	4	10	8	2
Shangzhi	2	616,046	314,864	301,182	3	0	3	0	0	0
Shanghai	1	6,181,334	3,084,496	3,096,838	220	167	53	189	152	37
Jintan	2	545,000	26,2407	282,593	11	7	4	11	8	3
Suzhou	1	2,392,087	1,183,716	1,208,371	79	55	24	51	37	14
Haian	2	936,785	463,612	473,173	16	10	6	16	9	7
Qidong	2	1,114,951	548,805	566,146	38	25	13	25	17	8
Haimen	2	1,016,228	501,407	514,821	32	18	14	13	11	2
Lianyungang	1	886,862	452,358	434,504	16	12	4	10	6	4
Donghai	2	1,117,858	579,751	538,107	17	9	8	11	9	2
Guanyun	2	1,015,229	534,502	480,727	19	13	6	16	14	2
Chuzhou District, Huai'an	1	1,174,877	609,088	565,789	14	9	5	11	7	4
Huaiyin District, Huai'an	1	900,027	465,502	434,525	13	10	3	2	0	2
Xuyi	2	759,450	388,180	371,270	29	20	9	7	4	3
Jinhu	2	352,292	176,689	175,603	11	9	2	5	4	1
Sheyang	2	965,817	494,682	471,135	24	18	6	15	9	6
Jianhu	2	805,465	410,369	395,096	9	7	2	9	7	2
Dafeng	2	724,147	363,326	360,821	11	7	4	7	4	3
Yangzhong	2	272,046	134,758	137,288	9	8	1	2	2	0
Taixing	2	1,128,840	613,199	515,641	17	12	5	10	7	3
Hangzhou	1	6,753,509	3,403,893	3,349,616	363	240	123	110	80	30
Jiaxing	1	509,367	253,819	255,548	16	14	2	12	8	4
Jiashan	2	382,475	189,692	192,783	15	12	3	10	8	2
Haining	2	653,957	322,969	330,988	31	22	9	8	7	1
Shangyu	2	771,321	383,462	387,859	21	17	4	16	15	1
Xianju	2	490,070	255,438	234,632	14	12	2	7	6	1
Feixi	2	858,895	449,882	409,013	18	14	4	8	6	2
Maanshan	1	633,477	323,834	309,643	35	24	11	6	4	2
Tongling	1	433,545	221,375	212,170	8	6	2	5	5	0
Changle	2	673,717	355,091	318,626	21	17	4	14	13	1
Xiamen	1	1,160,135	583,873	576,262	89	63	26	26	19	7
Zhanggong District, Ganzhou	1	420,759	212,159	208,600	30	18	12	14	10	4
Linqu	2	817,857	417,434	400,423	7	7	0	5	4	1
Wenshang	2	762,828	388,454	374,374	3	2	1	1	0	1

(To be continued)

Table 1. Population and number of new nasopharyngeal carcinoma (NPC) cases and deaths in cancer registries in 2009 (continued)

Registry	Area ^a	Population			New NPC cases			NPC deaths		
		Both	Males	Females	Both	Males	Females	Both	Males	Females
Feicheng	2	733,501	358,739	374,762	6	2	4	7	4	3
Yanshi	2	602,266	306,192	296,074	1	1	0	2	1	1
Linzhou	2	108,0241	557,392	522,849	3	0	3	3	3	0
Xiping	2	858,002	434,899	423,103	6	4	2	1	0	1
Wuhan	1	4,832,174	2,484,622	2,347,552	173	122	51	98	73	25
Yunmeng	2	524,801	261,237	263,564	13	10	3	8	7	1
Hengdong	2	713,458	373,923	339,535	33	23	10	13	7	6
Guangzhou	1	3,968,216	2,014,580	1,953,636	662	480	182	374	267	107
Sihui	2	413,363	211,351	202,012	122	79	43	79	53	26
Zhongshan	1	1,468,391	732,333	736,058	263	189	74	139	91	48
Liuzhou	1	1,038,208	533,050	505,158	68	52	16	42	30	12
Fusui	2	444,332	236,000	208,332	19	15	4	12	11	1
Jiulongpo District, Chongqing	1	798,618	402,961	395,657	25	21	4	12	10	2
Qinyang District, Chengdu	1	534,701	277,154	257,547	29	25	4	12	8	4
Ziliujing District, Zigong	1	357,600	179,873	177,727	14	11	3	4	2	2
Yanting	2	610,103	316,499	293,604	20	12	8	13	8	5
Jingtai	2	233,609	119,953	113,656	2	1	1	2	1	1
Liangzhou District, Wuwei	1	990,583	524,276	466,307	10	5	5	8	4	4
Xining	1	882,839	439,175	443,664	10	6	4	8	4	4
Xinyuan	2	271,944	138,895	133,049	5	2	3	2	1	1
Total		85,470,522	43,231,554	42,238,968	3,085	2,197	888	1,702	1,219	483

^a 1, urban area; 2, rural area.

Table 2. NPC incidence by sex and area in regions covered by the cancer registries in 2009

Location	Sex	No. of cases	Crude rate (1/10 ⁵)	Ratio	ASIC (1/10 ⁵)	ASIW (1/10 ⁵)	Cumulative rate (%) Age 0–74
All areas	Both	3,085	3.61	1.26	2.05	2.54	0.28
	Males	2,197	5.08	1.60	2.89	3.60	0.40
	Females	888	2.10	0.83	1.21	1.47	0.16
Urban	Both	2,407	4.19	1.38	2.33	2.88	0.32
	Males	1,725	5.95	1.80	3.32	4.12	0.46
	Females	682	2.39	0.87	1.35	1.65	0.18
Rural	Both	678	2.42	0.97	1.44	1.80	0.19
	Males	472	3.31	1.13	1.97	2.48	0.28
	Females	206	1.50	0.73	0.90	1.09	0.11

ASIC, age-standardized incidence by Chinese population; ASIW, age-standardized incidence by world population.

females.

Discussion

For this analysis of NPC incidence and mortality in 2009, 72 registries were qualified as sources of the annual report on cancer burden in 2009. The data in this report covered 85.47 million people (about 57.49 million from 31 urban areas), which is the largest population coverage to date. We analyzed NPC cases including 3,085 newly diagnosed patients and 1,702 deaths—data that might be

representative of the whole country.

Compared with other studies in China during past decades, the incidence of NPC has remained stable^[14] or slightly decreased^[7] in females in low-risk regions, or has slightly increased in males in some high-risk regions^[15]. NCCR data analysis revealed that the crude incidence and mortality fluctuated slightly in 2009 due to different population coverage. Additionally, NCCR results showed that incidence was higher in males than in females. The crude incidence in urban areas was also slightly higher than that in rural areas for both males and females. After age standardization, incidences were

Table 3. Age-specific incidence of NPC in regions covered by the cancer registries in 2009 (1/10⁵)

Age group	All areas			Urban areas			Rural areas		
	Both	Males	Females	Both	Males	Females	Both	Males	Females
All	3.61	5.08	2.10	4.19	5.95	2.39	2.42	3.31	1.50
<1	0.16	0.00	0.34	0.26	0.00	0.55	0.00	0.00	0.00
1-4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5-9	0.06	0.05	0.06	0.09	0.09	0.10	0.00	0.00	0.00
10-14	0.04	0.04	0.05	0.04	0.07	0.00	0.05	0.00	0.11
15-19	0.18	0.18	0.19	0.20	0.22	0.17	0.16	0.10	0.22
20-24	0.38	0.37	0.39	0.37	0.37	0.36	0.42	0.37	0.47
25-29	0.61	0.54	0.68	0.72	0.70	0.73	0.36	0.18	0.55
30-34	1.63	2.33	0.91	1.98	2.87	1.08	0.97	1.34	0.60
35-39	3.23	4.47	1.98	3.69	5.06	2.30	2.32	3.31	1.32
40-44	4.38	6.02	2.70	5.10	7.30	2.85	2.93	3.47	2.37
45-49	5.89	8.52	3.16	6.99	10.23	3.61	3.41	4.63	2.15
50-54	6.73	9.67	3.70	7.55	10.90	4.12	4.65	6.58	2.62
55-59	7.67	11.41	3.91	8.09	11.96	4.27	6.67	10.13	3.04
60-64	8.63	12.75	4.50	9.75	14.57	5.03	6.21	8.95	3.32
65-69	7.73	11.11	4.42	8.96	12.33	5.75	5.27	8.78	1.65
70-74	8.27	12.34	4.54	9.50	14.44	5.03	5.32	7.42	3.30
75-79	7.20	10.71	4.09	7.95	11.80	4.50	5.26	7.81	3.04
80-84	6.42	9.47	4.00	6.09	9.71	3.16	7.24	8.84	6.04
≥ 85	5.79	8.04	4.36	5.34	8.34	3.38	6.96	7.20	6.82

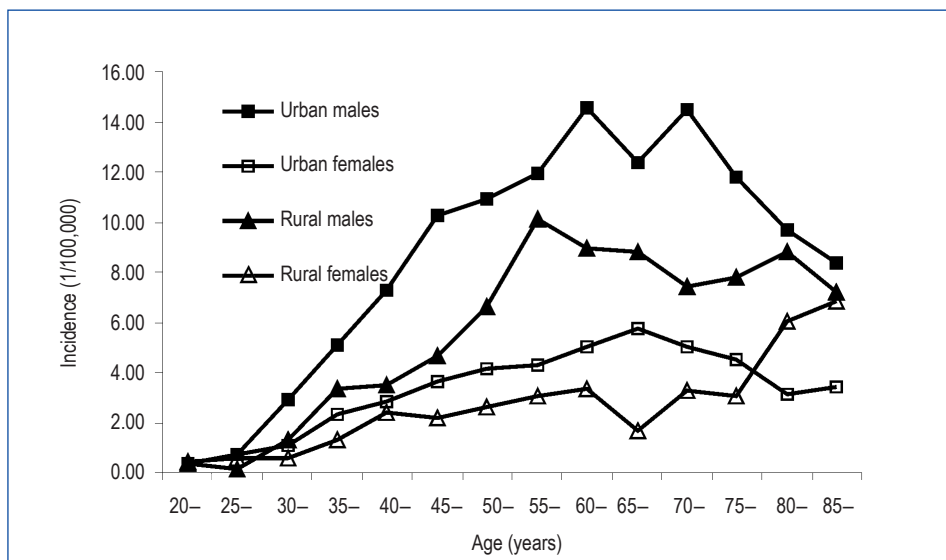


Figure 1. Age-specific incidence of nasopharyngeal carcinoma (NPC) in males and females in urban and rural areas in 2009. The age-specific incidence increased as age increased and peaked in the 60–64 age group in urban males, in the 55–59 age group in rural males, in the 65–69 age group in urban females, and in the 85 and over age group in rural females. Incidences in urban areas were higher than those in rural areas except among females over the age of 75, and incidences in males were higher than those in females in any age group.

still higher in males and in urban areas compared to females and rural areas, respectively. The results showed that the age-specific incidence of persons in the 60–64 year old age group in urban areas was 1–2 times higher than that in rural areas, both in males and females.

Although a rare disease worldwide, NPC shows a relatively high incidence among the Chinese, probably because of Epstein-Barr virus (EBV) infection, lifestyle, or smoking-related factors^[16]. In endemic

areas in China, NPC remains a common and fatal disease. The prevention strategy in China focuses mainly on secondary prevention, with a goal of improving rates of early detection and diagnosis in NPC patients and thereby giving high-risk populations a clinically valuable survival advantage^[17]. Since the 1970s, NPC screening tests and studies for high-risk areas in southern China, such as Sihui, have included monitoring for EBV using anti-EBV serum biomarkers^[18-22], but there is still no confirmed screening scheme for a larger sample

Table 4. NPC mortality by sex and area in regions covered by the cancer registries in 2009

Location	Sex	No. of cases	Crude rate (1/10 ⁵)	Ratio	ASMC (1/10 ⁵)	ASMW (1/10 ⁵)	Cumulative rate (%) Age 0–74
All areas	Both	1,702	1.99	1.10	1.04	1.35	0.15
	Males	1,219	2.82	1.26	1.51	1.97	0.22
	Females	483	1.14	0.84	0.57	0.74	0.09
Urban	Both	1,320	2.30	1.26	1.15	1.50	0.17
	Males	946	3.26	1.46	1.69	2.21	0.25
	Females	374	1.31	0.94	0.63	0.82	0.10
Rural	Both	382	1.37	0.77	0.78	1.00	0.11
	Males	273	1.92	0.85	1.12	1.42	0.17
	Females	109	0.79	0.62	0.43	0.56	0.06

ASMC, age-standardized mortality by Chinese population; ASMW, age-standardized mortality by world population.

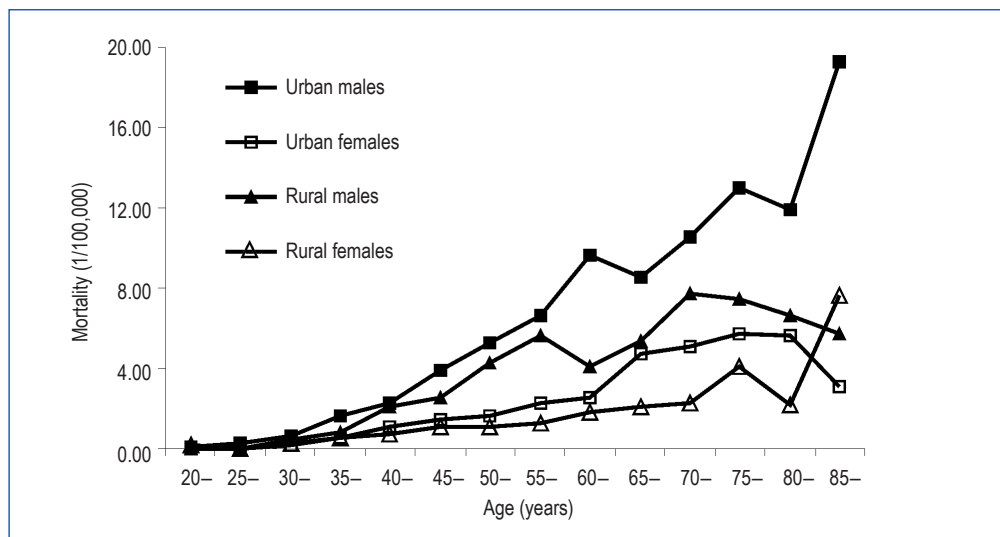


Figure 2. Age-specific mortality of NPC in cancer registration areas in 2009. The age-specific mortality increased as age increased. However, a decline was observed starting in the 70–74 age group in rural males and the 80–84 age group in urban females. Mortalities in urban areas were higher than those in rural areas except among females over 85 years of age, and mortalities in males were higher than those in females in any age group.

Table 5. Age-specific mortality of NPC in regions covered by the cancer registries in 2009 (1/10⁵)

Age group	All areas			Urban areas			Rural areas		
	Both	Males	Females	Both	Males	Females	Both	Males	Females
All	1.99	2.82	1.14	2.30	3.26	1.31	1.37	1.92	0.79
<1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1–4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5–9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10–14	0.04	0.08	0.00	0.04	0.07	0.00	0.05	0.10	0.00
15–19	0.06	0.07	0.04	0.03	0.06	0.00	0.11	0.10	0.11
20–24	0.07	0.05	0.08	0.06	0.07	0.04	0.09	0.00	0.19
25–29	0.11	0.19	0.03	0.16	0.27	0.04	0.00	0.00	0.00
30–34	0.38	0.54	0.21	0.40	0.60	0.19	0.34	0.42	0.26
35–39	0.97	1.36	0.58	1.11	1.63	0.58	0.69	0.81	0.58
40–44	1.60	2.17	1.01	1.69	2.23	1.13	1.42	2.06	0.76
45–49	2.43	3.50	1.33	2.71	3.92	1.44	1.82	2.53	1.08
50–54	3.27	5.01	1.47	3.48	5.30	1.62	2.72	4.29	1.09
55–59	4.16	6.32	1.98	4.42	6.61	2.26	3.52	5.67	1.27
60–64	5.08	7.85	2.30	6.05	9.66	2.51	2.99	4.08	1.82
65–69	5.66	7.48	3.89	6.62	8.57	4.76	3.75	5.39	2.06

(To be continued)

Table 5. Age-specific mortality of NPC in regions covered by the cancer registries in 2009 (1/10⁵) (continued)

Age group	All areas			Urban areas			Rural areas		
	Both	Males	Females	Both	Males	Females	Both	Males	Females
70–74	6.90	9.71	4.32	7.72	10.58	5.14	4.93	7.69	2.29
75–79	8.16	11.46	5.23	9.14	12.99	5.69	5.62	7.42	4.06
80–84	7.22	10.48	4.64	8.46	11.93	5.64	4.09	6.63	2.20
≥ 85	8.75	15.70	4.36	9.44	19.29	3.05	6.96	5.76	7.67

size nationwide. Nevertheless, screening for plasma EBV DNA^[22] in persons in high-risk age ranges^[6, 19], as well as health education and promotion should become standard practice for high-risk areas in China.

In conclusion, although the incidence of NPC remains stable and low in most age groups, especially in the young generation, it is still a major public issue in high-risk regions in China, especially among persons in high-risk age ranges. The cancer registry provides timely and dynamic information for making national, regional, and local policies for cancer control. As NCCR continues to expand the national

cancer registry system, primary and secondary prevention of NPC is expected to improve.

Acknowledgments

We thank all staff from local cancer registries for sharing their cancer registration databases.

Received: 2013-06-25; revised: 2013-06-28;
accepted: 2013-07-10.

References

- [1] Huang TR, Zhang SW, Chen WQ, et al. Trends in nasopharyngeal carcinoma mortality in China, 1973–2005. *Asian Pac J Cancer Prev*, 2012,13:2495–2502.
- [2] Black RJ, Bray F, Ferlay J, et al. Cancer incidence and mortality in the European Union: cancer registry data and estimates of national incidence for 1990. *Eur J Cancer*, 1997,33:1075–1107.
- [3] Yu MC, Yuan JM. Epidemiology of nasopharyngeal carcinoma. *Semin Cancer Biol*, 2002,12:421–429.
- [4] Ren JS, Chen WQ, Shin HR, et al. A comparison of two methods to estimate the cancer incidence and mortality burden in China in 2005. *Asian Pac J Cancer Prev*, 2010,11:1587–1594.
- [5] Chang ET, Adami HO. The enigmatic epidemiology of nasopharyngeal carcinoma. *Cancer Epidemiol Biomarkers Prev*, 2006,15:1765–1777.
- [6] Cao SM, Simons MJ, Qian CN. The prevalence and prevention of nasopharyngeal carcinoma in China. *Chin J Cancer*, 2011,30:114–119.
- [7] Yang WS, Yang C, Zheng JW, et al. Time trend analysis of incidence rate for nasopharyngeal carcinoma in urban Shanghai. *Zhonghua Liu Xing Bing Xue Za Zhi*, 2009,30:1171–1174. [in Chinese]
- [8] National Office for Cancer Prevention and Control & National Central Cancer Registry. The guideline of Chinese cancer registration. Beijing: The Peking Union Medical College Press, 2004. [in Chinese]
- [9] Cancer incidence in five continents. Volume IX. IARC Sci Publ, 2008:1–837.
- [10] Curado MP, Edwards B, Shin HR, et al. Cancer incidence in five continents, vol. LX. Lyon: IARC, Scientific Publications No. 160, 2007.
- [11] Parkin DM. Comparability and quality control in cancer registration. Lyon: IARC, 1994.
- [12] Ferlay J, Burkhard C, Whelan S, et al. Check and conversion programs for cancer registries. Lyon: IARC, 2005.
- [13] National Office for Cancer Prevention and Control, National Center for Cancer Registry, Disease Prevention and Control Bureau, MOH. Chinese cancer registry annual report (2010). Beijing: Military Medical Science Press, 2011:2.
- [14] Xie SH, Gong J, Yang NN, et al. Time trends and age-period-cohort analyses on incidence rates of nasopharyngeal carcinoma during 1993–2007 in Wuhan, China. *Cancer Epidemiol*, 2012,36:8–10.
- [15] Jia WH, Huang QH, Liao J, et al. Trends in incidence and mortality of nasopharyngeal carcinoma over a 20–25 year period (1978/1983–2002) in Sihui and Cangwu counties in southern China. *BMC Cancer*, 2006,6:178.
- [16] Arnold M, Wildeman MA, Visser O, et al. Lower mortality from nasopharyngeal cancer in the Netherlands since 1970 with differential incidence trends in histopathology. *Oral Oncol*, 2013,49:237–243.
- [17] Ng WT, Choi CW, Lee MC, et al. Outcomes of nasopharyngeal carcinoma screening for high risk family members in Hong Kong. *Fam Cancer*, 2010,9:221–228.
- [18] Rao DP, Liu Q, Cao SM. Cost-effectiveness evaluation of seven screening strategies for nasopharyngeal carcinoma. *Zhonghua Zhong Liu Za Zhi*, 2012,34:549–553. [in Chinese]
- [19] Liu Y, Huang Q, Liu W, et al. Establishment of VCA and EBNA1 IgA-based combination by enzyme-linked immunosorbent assay as preferred screening method for nasopharyngeal carcinoma: a two-stage design with a preliminary performance study and a mass screening in southern China. *Int J Cancer*, 2012,131:406–416.

- [20] Chen F, Huang QH, Fang F, et al. Interval cancers in nasopharyngeal carcinoma screening: comparing two screening intervals after a negative initial screening result. *J Med Screen*, 2012,19:195–200.
- [21] Cao SM, Liu Z, Jia WH, et al. Fluctuations of Epstein-Barr virus serological antibodies and risk for nasopharyngeal carcinoma: a prospective screening study with a 20-year follow-up. *PLoS One*, 2011,6:e19100.
- [22] Chan KC, Hung EC, Woo JK, et al. Early detection of nasopharyngeal carcinoma by plasma Epstein-Barr virus DNA analysis in a surveillance program. *Cancer*, 2013,119:1838–1844.