

Original Article

Nasopharyngeal carcinoma incidence and mortality in China in 2010

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Abstract

Nasopharyngeal carcinoma (NPC) is common in South China. Although regional epidemiological data on NPC in China is available, national epidemiological data have been unavailable up to now. The goal of this study was to analyze the NPC incidence and mortality data in some domestic cancer registries, estimate these rates in China in 2010, and provide scientific information that can be harnessed for NPC control and prevention. To accomplish this goal, NPC incidence and mortality data for 2010 were collected from 145 Chinese cancer registries from which data were included in the 2013 National Cancer Registry Annual Report. Such indices as its incident and death numbers, crude rates, age-standardized rates and truncated rates were calculated and analyzed. The incidence and mortality in China and constituent areas were estimated according to the national population in 2010. An estimated 41,503 new cases and 20,058 deaths were attributed to NPC in China in 2010, accounting for 1.34% of all new cancer cases and 1.03% of all cancer-related deaths that year in China. Crude incidence and mortality were 3.16/100,000 and 1.53/100,000, respectively. World age-standardized incidence and mortality were 2.44/100,000 and 1.18/100,000, respectively. Incidence and mortality were higher among males than among females and slightly higher in urban areas than in rural areas. Among seven Chinese administrative regions, NPC incidence and mortality were obviously higher in South China than in other regions and lowest in North China. The male and female age-specific incidence and mortality both rose quickly from age 25–29 years, but peaked at different ages and varied by location. These results demonstrated that NPC incidence and mortality in China especially in South China were at high levels in the world, and suggested that control and prevention efforts should be enhanced.

Key words Nasopharyngeal carcinoma, incidence, mortality, China

Nasopharyngeal carcinoma (NPC) is a common malignancy in South China^[1,2]. More specifically, NPC incidence and mortality are higher in Guangdong, Guangxi, Hainan, Jiangxi, and Fujian provinces than in other regions in China^[3-5]. In particular, the incidence in Zhongshan City of Guangdong Province ranked first in the Cancer Incidence in Five Continents, volumes 9^[6] and 10^[7], thus indicating a significant health concern to the residents there. At present, there is only regional NPC epidemiological data in China with no national

data. To fill this gap, we estimated NPC incidence and mortality in China and its constituent areas in 2010 according to data from 145 domestic cancer registries and the national population in 2010.

Data and Methods

Data source

NPC incidence and mortality data in 2010 were collected from 145 domestic cancer registries with data quality that met the criteria of National Center for Cancer Registration; namely, the percentage of cases with morphological verification (MV%), >66%; the percentage of cases with death certification only (DCO%), <15%; and ratio of mortality to incidence (M/I), 0.6–0.8. The registries that reported cancer data to National Center for Cancer Registration were divided into four grades based on the criteria listed above. Grade A (52

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registries) and grade B (73 registries) had high data quality; grade C (20 registries) only included individual indices that did not meet the criteria of grade B; and grade D registries had poor data quality. Data from grade A, B, and C registries were included in the 2013 National Cancer Registry Annual Report, whereas data from grade D registries were not. Of the 145 registries (grades A, B, and C) included in this study, 63 were based in urban areas and 82 were based in rural areas. These registries were distributed across 28 provinces, autonomous regions, and municipalities directly under central government.

Population data was collected from the Statistical and/or Public Security Bureaus of the aforementioned cancer registry areas. The registries in this study covered a population of 158,403,248, accounting for 11.79% of the total population in China at the end of 2010. Of the population covered, 80,355,188 were males and 78,048,060 were females, and 92,433,739 (58.35%) came from urban areas, whereas 65,969,509 (41.65%) came from rural areas^[8].

Per the National Bureau of Statistics' criteria, the areas covered by the cancer registries in this study were classified as eastern, middle, western areas and divided into seven administrative regions: South China, North China, Central China, East China, Southwest China, Northwest China, and Northeast China.

Statistical indices and methods

NPC data coded as C11 in the tenth version of the International

Classification of Diseases (ICD-10) were statistically analyzed in this study using methods recommended by the Guideline for Chinese Cancer Registration^[9]. Statistical indices included incident and death numbers, proportions, crude rates, age-standardized rates (ASRs), cumulative rates, truncated rates (for ages 35 to 64 years), and age-specific rates. These indices were stratified by area, region, and sex. The standard population of China in 2000 and of the world in 1960 (Segi) were used for calculating ASR China and ASR world, respectively.

Age-specific estimates of new cases and deaths at each stratum were obtained by multiplying the age-specific incidence and mortality with the age-specific population at each stratum from the 2010 population census. The nationwide estimates of new cases and deaths were obtained by pooling calculations^[9].

Results

Data quality

Data quality varied by registry location (**Table 1**). The quality of data from registries in urban areas was higher than that in rural areas; although quality was similar for data from registries in middle and eastern areas, it was lowest for data from registries in the western area. Specific measures of MV%, DCO%, M/I, and UB% (the proportion of diagnosis of unknown basis) of 2010 NPC data were as follows: for all registries, 74.55%, 1.72%, 0.48, and 1.43%,

Table 1. Quality of nasopharyngeal carcinoma (NPC) data in 2010 from Chinese cancer registries

Area	Sex	M/I	MV%	DCO%	UB%
All	Both sexes	0.48	74.55%	1.72%	1.43%
	Male	0.49	74.82%	1.79%	1.46%
	Female	0.46	73.90%	1.55%	1.36%
Urban areas	Both sexes	0.49	77.29%	1.85%	1.62%
	Male	0.49	77.20%	1.91%	1.56%
	Female	0.47	77.51%	1.69%	1.79%
Rural areas	Both sexes	0.46	69.70%	1.49%	1.09%
	Male	0.48	70.46%	1.57%	1.28%
	Female	0.44	67.93%	1.32%	0.66%
Eastern area	Both sexes	0.47	75.72%	1.41%	1.76%
	Male	0.48	76.02%	1.49%	1.83%
	Female	0.46	74.93%	1.22%	1.57%
Middle area	Both sexes	0.47	75.86%	2.05%	0.22%
	Male	0.49	75.82%	2.04%	0.16%
	Female	0.43	75.95%	2.06%	0.34%
Western area	Both sexes	0.54	63.72%	3.43%	1.08%
	Male	0.57	63.66%	3.71%	0.80%
	Female	0.47	63.84%	2.82%	1.69%

M/I, the ratio of mortality to incidence; MV%, the percentage of cases morphologically verified; DCO%, the percentage of death certificate-only cases; UB%, the proportion of diagnosis of unknown basis.

respectively; for urban registries, 77.29%, 1.85%, 0.49, and 1.62%, respectively; and for rural registries, 69.70%, 1.49%, 0.46, and 1.09%, respectively.

Incidence estimation

An estimated 41,503 new cases of NPC occurred in 2010, accounting for 1.34% of all new cancer cases in China in that year. The crude, ASR China, and ASR world incidences were 3.16/100,000, 2.60/100,000, and 2.44/100,000, respectively. An estimated 29,158 new NPC cases among males occurred in 2010, accounting for 0.96% of all new cancer cases in males in China in 2010. The crude, ASR China, and ASR world incidences among males were 4.33/100,000, 3.61/100,000, and 3.40/100,000, respectively. An estimated 12,345 new NPC cases among females occurred in 2010, accounting for 0.96% of all new cancer cases among females in China in 2010. The crude, ASR China, and ASR world incidences among females were 1.92/100,000, 1.56/100,000, and 1.47/100,000, respectively. These incidences aforementioned among males were higher than those among females. The number of new cases among males in urban, rural, and both areas was 2.51 times, 2.22 times, and 2.36 times, respectively, greater than those among females (**Table 2**).

Age-specific incidence

Age-specific incidence rose quickly from age 25–29 years,

peaked at age 60–64 years, thereafter decreased markedly for males and gradually for females. Age-specific incidence was higher among males than among females and varied by area (**Figure 1**). In the western area, it peaked at age 85+ for both males and females, whereas at age 70–74 in males in the middle area. After peaking, the age-specific incidence declined sharply for both males and females in the eastern area and for females in the middle area.

Incidence difference between regions

An estimated 21,593 new cases of NPC occurred in urban areas in 2010, accounting for 1.27% of all new cancer cases in urban areas that year. The crude, ASR China, and ASR world incidences in urban areas were 3.25/100,000, 2.63/100,000, and 2.46/100,000, respectively. In rural areas, An estimated 19,964 new NPC cases occurred, accounting for 1.43% of all new cancer cases in rural areas in 2010. The crude, ASR China, and ASR world incidences in rural areas were 3.06/100,000, 2.59/100,000, and 2.45/100,000, respectively (**Table 2**). NPC incidence was only slightly higher in urban areas than in rural areas; the crude, ASR China, and ASR world incidences in urban areas were 1.06 times, 1.02 times, and 1.00 times, respectively, higher than the rates for rural areas.

NPC incidence was highest in the western area, less high in the eastern area, and lowest in the middle area in 2010. However, for urban areas specifically, incidence was highest in the eastern area, less high in the western area, and lowest in the middle area.

Table 2. NPC incidence in China in 2010

Area	Sex	Total (cases)	CR (1/10 ⁵)	Prop (%)	ASR-C (1/10 ⁵)	ASR-W (1/10 ⁵)	Cum rate 0–74 (%)	TASR (1/10 ⁵)	Rank
All	Both	41,503	3.16	1.34	2.60	2.44	0.27	5.55	18
	Male	29,158	4.33	1.61	3.61	3.40	0.37	7.78	13
	Female	12,345	1.92	0.96	1.56	1.47	0.16	3.24	18
Urban areas	Both	21,539	3.25	1.27	2.63	2.46	0.27	5.55	19
	Male	15,398	4.54	1.58	3.70	3.47	0.37	7.96	13
	Female	6,141	1.90	0.85	1.53	1.42	0.16	3.06	19
Rural areas	Both	19,964	3.06	1.43	2.59	2.45	0.27	5.58	15
	Male	13,760	4.12	1.65	3.53	3.34	0.37	7.63	10
	Female	6,204	1.95	1.11	1.62	1.55	0.17	3.45	16
Eastern area	Both	18,512	3.37	1.44	2.78	2.57	0.27	6.02	18
	Male	13,393	4.76	1.84	3.96	3.68	0.39	8.67	13
	Female	5,119	1.91	0.92	1.56	1.43	0.15	3.27	18
Middle area	Both	10,840	2.57	1.08	2.08	1.98	0.23	4.57	19
	Male	7,518	3.49	1.29	2.85	2.74	0.31	6.27	13
	Female	3,322	1.61	0.78	1.30	1.23	0.14	2.82	20
Western area	Both	12,151	3.55	1.52	2.97	2.83	0.31	6.08	16
	Male	8,247	4.69	1.66	3.99	3.77	0.41	8.27	12
	Female	3,904	2.34	1.28	1.91	1.85	0.21	3.78	16

CR, crude rate; Prop, proportion; ASR-C, age-standardized rate by Chinese standard population; ASR-W, age-standardized rate by Segi's world standard population; Cum rate, cumulative rate; TASR, truncated age-standardized rate.

Generally, NPC incidence were not significantly different between the three aforementioned areas, especially between the eastern and western areas (Table 2). NPC incidence ranked from highest to lowest among the seven administrative regions as follows: South China, Southwest China, Central China, East China, Northwest China, Northeast China, and North China. Notably, the incidence in South China was 3 times higher than that in Southwest China, in

which the incidence was the second highest.

Mortality estimation

In 2010, there were an estimated 20,058 deaths caused by NPC, accounting for 1.03% of all cancer deaths in China that year. The crude , ASR China, and ASR world mortalities were 1.53/100,000,

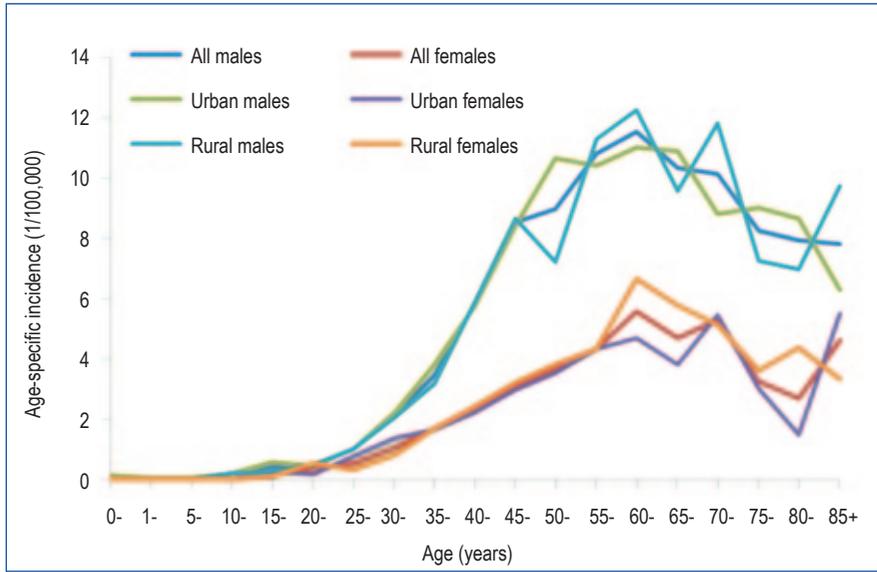


Figure 1. Nasopharyngeal carcinoma (NPC) age-specific incidence in China in 2010. NPC age-specific incidence rose quickly from age 25–29 years, peaked at age 60–64 years, thereafter decreased obviously for males and began to decrease for females. Male rates are obviously higher than the rates of female. The age-specific incidence varied in areas.

Table 3. NPC mortality in China in 2010

Area	Sex	Total (cases)	CR (1/10 ⁵)	Prop (%)	ASR-C (1/10 ⁵)	ASR-W (1/10 ⁵)	Cum rate 0–74 (%)	TASR (1/10 ⁵)	Rank
All	Both	20,058	1.53	1.03	1.20	1.18	0.14	2.39	17
	Male	14,536	2.16	1.16	1.74	1.71	0.20	3.59	12
	Female	5,522	0.86	0.79	0.65	0.65	0.07	1.15	18
Urban areas	Both	10,867	1.64	1.05	1.22	1.20	0.14	2.46	18
	Male	7,962	2.35	1.22	1.79	1.76	0.21	3.74	14
	Female	2,905	0.90	0.76	0.64	0.63	0.07	1.13	18
Rural areas	Both	9,191	1.41	1.00	1.18	1.17	0.13	2.32	16
	Male	6,574	1.97	1.09	1.69	1.67	0.19	3.45	10
	Female	2,617	0.82	0.82	0.67	0.66	0.07	1.17	16
Eastern area	Both	8,311	1.51	1.02	1.18	1.15	0.13	2.28	17
	Male	6,073	2.16	1.18	1.72	1.69	0.19	3.42	13
	Female	2,238	0.83	0.74	0.62	0.61	0.07	1.10	18
Middle area	Both	5,096	1.21	0.83	0.94	0.93	0.11	1.92	19
	Male	3,676	1.71	0.93	1.37	1.35	0.16	2.88	13
	Female	1,420	0.69	0.64	0.51	0.51	0.05	0.93	18
Western area	Both	6,651	1.94	1.27	1.55	1.54	0.18	3.16	15
	Male	4,787	2.72	1.39	2.21	2.19	0.26	4.75	10
	Female	1,864	1.12	1.04	0.87	0.86	0.10	1.50	15

Abbreviations as in Table 2.

1.20/100,000, and 1.18/100,000, respectively. An estimated 14,536 males died of NPC, accounting for 1.16% of all cancer deaths among males in 2010 in China. The crude, ASR China, and ASR world mortalities among males were 2.16/100,000, 1.74/100,000, and 1.71/100,000, respectively. NPC also led to the death of an estimated 5,522 females, accounting for 0.79% of all cancer deaths among females in 2010 in China. The crude, ASR China, and ASR world mortalities among females were 0.86/100,000, 0.65/100,000, and 0.65/100,000, respectively. Mortality was higher among males than among females; the number of deaths among males in urban, rural, and both areas were 2.74 times, 2.51 times, and 2.63 times, respectively, greater than that among females in those areas (Table 3).

Age-specific mortality

Male and female age-specific mortalities for NPC in China in 2010 began to rise quickly from age 30–34 years, peaked at age 80–84 years, and decreased thereafter for males but peaked at age 85+ for females. Age-specific mortality was notably higher among males than among females but was similar in older age groups (Figure 2). These mortalities varied by area. In rural areas, the age-specific mortality peaked at age 75–79 years. In eastern and middle areas, the peak was at age 85+, and in the western area, the peak was at age 60–64 years for males and age 80–84 years for females.

Mortality differences between regions

There were an estimated 10,867 deaths linked to NPC in urban areas in 2010, accounting for 1.05% of all cancer deaths in Chinese urban areas that year. The crude, ASR China, and ASR world mortalities in urban areas were 1.64/100,000, 1.22/100,000, and 1.20/100,000, respectively. In rural areas, there were an estimated 9,191 deaths linked to NPC, accounting for 1.00% of all cancer

deaths in Chinese rural areas in 2010. The crude, ASR China, and ASR world mortalities in rural areas were 1.41/100,000, 1.18/100,000, and 1.17/100,000, respectively (Table 3). The mortalities in urban areas and rural areas were similar, with the former only slightly higher than the latter. The crude, ASR China, and ASR world mortalities were 1.16 times, 1.03 times, and 1.03 times, respectively, higher in urban areas than in rural areas.

The geographic distribution of deaths linked to NPC in China in 2010 was basically consistent with its incidence. More specifically, the western area had the highest mortality, followed by the eastern area, and the middle area had the lowest. However, for urban areas, the mortality was highest in the eastern area, less high in the western area, and lowest in the middle area. Generally, there were no large differences between the mortalities of the eastern, western, and middle areas. Mortality ranked from highest to lowest among the seven administrative regions as follows: South China, Southwest China, Central China, East China, Northwest China, Northeast China, and North China. Notably, as with its incidence, NPC mortality was 3 times higher in South China than in Southwest China, in which the mortality was the second highest. For males in urban areas, mortality was slightly higher in Central and East China than in Southwest China.

Discussions

According to GLOBOCAN 2012, the estimated ASR world for NPC incidence among males and females in 2012 were 1.7/100,000 and 0.7/100,000, respectively. The areas with the highest incidence were Southeast Asia (6.4/100,000 for males and 2.4/100,000 for females), Micronesia (3.3/100,000 and 2.0/100,000), East Asia (2.5/100,000 and 1.0/100,000), North Africa (2.3/100,000 and 1.0/100,000), and East Africa (1.9/100,000 and 1.1/100,000). The countries with the highest incidence were Malaysia (10.6/100,000 for males and

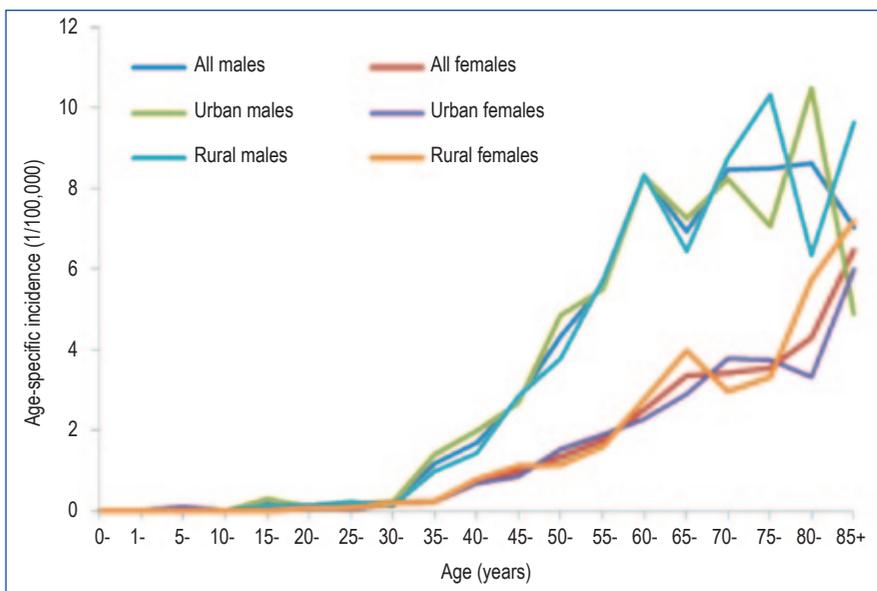


Figure 2. NPC age-specific mortality in China in 2010. All male and female NPC age-specific mortalities in China in 2010 rose quickly from age 30–34 years, peaked at age 80–84 years and down thereafter for males, but peaked at age 85+ for females. Male rates are obviously higher than the rates of females, but close to each other in old age groups. The age-specific death rates varied in areas, peaked at age 75–79 years in rural areas.

3.9/100,000 for females), Singapore (9.7/100,000 and 3.2/100,000), Indonesia (8.3/100,000 and 3.0/100,000), Vietnam (7.7/100,000 and 3.4/100,000), and Brunei (7.6/100,000 and 1.5/100,000). In 2012, ASR world for NPC mortality among males and females were 1.0/100,000 and 0.4/100,000, respectively. The areas with the highest mortality were Southeast Asia (3.8/100,000 for males and 1.4/100,000 for females), East Asia (1.5/100,000 and 0.6/100,000), East Africa (1.4/100,000 and 0.9/100,000), North Africa (1.4/100,000 and 0.6/100,000), and Micronesia (1.3/100,000 and 1.0/100,000). The countries with the highest mortality were Indonesia (5.0/100,000 and 1.6/100,000), Vietnam (4.8/100,000 and 2.0/100,000), Singapore (4.4/100,000 and 1.3/100,000), Malaysia (3.9/100,000 and 1.2/100,000), and Brunei (3.4/100,000 and 0.5/100,000)^[10]. Compared with GLOBOCAN 2012 data, the current study showed that NPC incidence and mortality were lower in China in 2010 than in Southeast Asia in 2012, but significantly higher than in the world, higher than in East Asia and in China estimated by GLOBOCAN 2012. NPC incidence among males and females in China in 2010 ranked 9th and 10th in the world, respectively, and were similar to the incidence in Burma and Tunis according to GLOBOCAN 2012. Likewise, NPC mortality among males and females in China in 2010 ranked 13th and 14th in the world, respectively, according to GLOBOCAN 2012, and similar to NPC mortality in the Philippines and Tunis. These results indicated that the 2010 NPC incidence and mortality in China were at high levels in the world. Furthermore, the results of our study were also similar to the results of the third national all-death-causes survey in China and 2009 Chinese Cancer Registry Annual Report^[3,11], indicating that cancer registering data in China were consistent with the data of the third national all-death-causes survey.

In the current study, NPC incidence and mortality were markedly higher in South China than in other Chinese regions. Indeed, the rates in South China were 3 times higher than those in the region with the second highest rates. By contrast, the incidence and mortality in North China were the lowest. These findings were consistent with previous reports^[1-4,10-15]. According to Cancer Incidence in Five Continents, volume 10^[7], top three registries with the highest NPC incidence were all located in South China: namely Zhongshan City of Guangdong Province, Macao, and Hong Kong. The incidence and mortality in Sihui City of Guangdong Province were even higher than those in Zhongshan^[3]. Moreover, the NPC incidences in Guangzhou City of Guangdong Province, Liuzhou City, Cangwu County, Wuzhou City, and Fusui County of Guangxi Province, Xiamen City of Fujian Province, Chengdu City of Sichuan Province, and Ganzhou City of Jiangxi Province were also relatively high^[3,4].

Although our study showed that NPC incidence and mortality were highest in the western area, less high in the eastern area, and lowest in the middle area, there were no large differences in the rates among them. The reasons might be that the areas with high NPC incidence before were assigned into different areas according to the criteria of National Statistic Bureau. For example, Guangdong Province and Fujian Province were assigned into the eastern area, Guangxi Province into the western area, and Jiangxi Province and Hunan Province into the middle area. NPC geographic distribution

features could be better described through stratification into seven administrative regions rather than three areas^[1]. The results of the third national all-death-causes survey in China showed that mortality was highest in the eastern area, less high in the western area, and lowest in the middle area, in contrast to our results. This difference might be due to the different geographic distribution of sampling places in the studies^[1,12].

The present study revealed that NPC incidence and mortality varied according to geography, sex, and age. However, there was no substantial difference between urban and rural areas. The underlying reason may be related to the factors of NPC incidence and mortality, which are associated with genetics, Epstein-Barr virus infection, environment, diet, smoking, occupation, and so on^[1]. NPC mortality is also associated with local health, economy, culture, and other factors^[5]. Thus, NPC incidence and mortality were similar in urban and rural areas, suggesting that there were no marked differences in factors linked to NPC incidence and mortality in these areas.

We determined that NPC incidence and mortality were significantly higher for males than for females, which was consistent with previous reports^[1-7,10-14]. Generally, the age-specific incidence and mortality were also consistent with the previous reports^[1,3,10,12,13,15,16]. However, the age-specific incidence and mortality peaked at different ages, depending on the region. For example, the peak age of death in Zhongshan City of Guangdong Province in 1970–2010^[5] and Guangxi Province in 2004–2005^[14] were at age 55–59 years.

In this study, the MV% of NPC data was higher than that of all cancer data (67.11%) and the DCO% was lower than that of all cancer data in 145 cancer registries in 2010 (2.99%)^[8]. However, the MV% in China in 2010 was slightly lower than that of NPC data in 2012 Chinese Cancer Registry Annual Report (76.14%)^[3] and 2003–2007 Cancer Incidence and Mortality in China (79.14%)^[10], significantly lower than that of NPC data in Cancer Incidence in Five Continents, volume 9 (96.28%)^[6], and that of oral and throat cancers (coded as C00-14 in ICD10) in volume 10^[7]. This suggested that NPC data quality in this study, especially for rural registries, should be improved.

Generally, although NPC data quality in this study should be improved, the results of this study showed that NPC incidence and mortality in 2010 in China, especially in South China, were high relative to worldwide levels, and these findings were consistent with previous reports^[1-4,10-15]. NPC incidence and mortality reported here are similar to the results of the third national all-death-causes survey in China and 2009 Chinese Cancer Registry Annual Report, indicating that the data from cancer registration was consistent with the data of the third national all-death-causes survey^[3,12]. Similarly, NPC incidence and mortality varied by geography, sex, and age, consistent with previous reports^[1-7,10-16]. However, the mortalities in eastern, middle, and western areas in this study differed from those of the third national all-death-causes survey, possibly because of different sampling places^[12]. Otherwise, stratification by the seven administration regions rather than by three areas could better describe NPC geographic distribution features.

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