RESEARCH COMMUNICATION


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Abstract

Yanting County is one of high risk areas of esophageal cancer in China. Recently, the economic level has improved to a new standard, but cancer issues have not been updated. This study aimed to describe the main cancer mortalities and change from 2004 to 2009 and provide an evidence base for future active strategies. Yanting Cancer Research Institute provided all cancer mortality data and age-standardized rates were calculated based on the world standard population 2000. Annual percentage change was used to estimate the time trend for each cancer. Mortality from upper gastrointestinal cancers, but not other cancers, was much higher than worldwide average figures. Rates for esophageal cancer declined over the 6 years, but lung cancer mortality showed an upward trend. For gastric and liver cancer, no obvious change was observed. Considering the high mortality from upper gastrointestinal cancers, it is necessary to take actions investigating the risk factors and addressing the issues of prevalent cancer challenges.

Keywords: High risk area - cancer mortality - esophageal cancer - gastric cancer - liver cancer - lung cancer - China

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Introduction

Cancer is now a leading cause of death and disability in poor countries and the burden of cancer becomes a major challenge to low-income and middle-income countries (Farmer et al., 2010). China, a developing country, there are many areas with high risk of cancers. Yanting, a rural and one the most indigent counties in Sichuan Province, locates in northeast of Chengdu city, at 105°latitude N and 31°longitude E. In 2007, the population was about 606,400 including 518,800 agricultural ones and 87,600 non-agricultural ones. Besides of poverty, Yanting was also well known for its serious challenge of esophageal cancer (EC) (Zhang et al., 2006). From 1998 to 2002, age-standardized incidence of EC in Yanting was 137.4/105 for males and 80.0/105 for females (Zhang et al., 2006), compared with the corresponding figures of 11.5/105 and 4.7/105 worldwide and 27.4/105 and 12.0/105 in China (Ferlay et al., 2004).

In 1970s, the Yanting Cancer Research Panel” had been established to investigate, analyze and prevent the cancer challenges locally. Though some studies on EC had been conducted (Yang et al., 2005; Yang et al., 2007), there was not any reports introducing the status of the cancers in Yanting, especially in recent years. And in 2010, WHO provided Global Cancer Statistics 2008 about the contemporary estimates of the incidence of, and mortality from major type of cancers, at national level, for all countries of the world. Therefore, we aimed to introduce the mortality and its temporal change of the main type of cancers in Yanting of recent years and make a complete comparison with the average figures of China and world.

Materials and Methods

Data about the cancer deaths was provided by Yanting Cancer Research Institute, which took the charge of all death causes registry in the whole county. Since 1971, a 3-level cancer reporting system has been founded in Yanting. The system includes 3 registry levels: village, township and county level. Each reporter in every village was responsible for the report of deaths and death causes occurring in the village by a standard card, then the cards were sent to the township health clinics. After verification, the cards were submitted to Yanting Cancer Research Institute, and there, they were checked, analyzed, coded and stored.

The study intended to describe the temporal changing trend of mortalities in total cancer, EC, gastric cancer, liver cancer and lung cancer, which accounted for more than 90% cancer deaths. The classification of cancers was accorded to ICD-10. The data collection was under the guidelines of Cancer Incidence in Five Continents Vol. IX from IARC (Curado et al., 2007), with more than 80% cases having pathological, cytological or hematological evidence. The number of population was the average of
populations at the beginning and the end of each year. The world standard population of 2000 proposed by WHO (Curado et al., 2007) was chosen to standardize each cancer mortality.

The mortalities of each cancer was obtained from Global Cancer Statistics 2008 (International Agency for Research on Cancer, 2010).

Statistical Analysis

Data was analyzed by SAS 9.1 software. Age-standardized rates of each cancer mortalities were calculated, with the reference of the world standard population in 2000. The temporal change of mortality was estimated by APC, which was calculated by fitting a regression line to the natural logarithm of the rates using calendar year as a regressor variable, i.e. \( y = mx + b \) where \( y = \ln (\text{rate}) \) and \( x = \text{calendar year} \). Then the APC = 100*(em -1) (Siesling et al., 2003). Testing the hypothesis that the APC is equal to zero is equivalent to testing the hypothesis that the slope of the regression line is zero, using the t-distribution of \( m/SEm \). The number of degrees of freedom equals the number of calendar years minus 2. The standard error of \( m \), i.e. \( SEm \), is obtained from the fit of the regression line (Siesling et al., 2003). In the above formula, the “rate” denoted age-standardized rate of cancer.

Results

Total cancers

In 2008, the mortality of all cancers in China was 158.6/10^5 in males and 91.6/10^5 in females and worldwide it was 128.8/10^5 in males and 87.6/10^5 in females (Table 1). In Yanting, from 2004 to 2009, the average age-standardized rate of mortality was 172.39/10^5 in males and 91.05/10^5 in females, the cancer mortality in males higher than average figures of China and world (Table 1). During this period, age-standardized rate of total cancer mortality changed from 202.71/10^5 to 169.47/10^5 in males and from 116.22/10^5 to 90.63/10^5 in females (Table 2, Figure 1) However, the annual percentage change of total cancer mortality did not get the statistical significance (p>0.05) (Table 2).

In Yanting, the 6-year average age-standardized rate of EC mortality was 54.7/10^5 in males and 31.6/10^5 in females, but the corresponding figures were 18.7/10^5 and 8.2/10^5 in China and 8.6/10^5 and 3.4/10^5 worldwide (Table 1). In 2004, age-standardized rate of EC mortality was 65.1/10^5 in males and 45.1/10^5 in females, 6 years later the corresponding figures changed to 47.88/10^5 and 26.4/10^5 (Table 2). A significantly reducing trend was observed for EC mortality (Figure 2). In females the annual reduce rate of EC mortality was 8.7% (p<0.05), however in males, the changing trend did not reach significance level (p>0.05) (Table 2).

Gastric cancer

The 6-year average age-standardized rate of gastric cancer mortality was 43.6/10^5 in males and 22.4/10^5 in females (Table 1). But in China gastric cancer mortality was 30.1/10^5 in males 14.6/10^5 in females; worldwide male mortality was 14.3/10^5 and female mortality was 6.9/10^5 (Table 1). Mortality of gastric cancer in yanting was higher than China and world. Age-standardized rate of gastric mortality in 2004 was 56.95/10^5 in males and 27.01/10^5 in females and in 2009 it was 39.75/10^5 in males and 22.06/10^5 (Table 2). It did not observe any significant change of liver cancer mortality from 2004 to 2009 in both genders (Table 2). In the 6-year period liver mortality was from 33.4/10^5 to 29.8/10^5 in males and from 16.0/10^5 to 11.4/10^5 in females (Table 2). The APC of liver mortality was not significant in either gender (Table 2).

Liver cancer

For liver cancer, the average age-standardized rate of mortality in Yanting was 28.7/10^5 in males 10.9/10^5 in females, and from IARC documents, the corresponding figures were 34.1/10^5 and 13.1/10^5 in China and 14.6/10^5 and 5.7/10^5 globally (Table 1). Yanting’s figures were similar as China, but much higher than World (Table 1). It did not observe any significant change of liver cancer mortality from 2004 to 2009 in both genders (Figure 2,3).

In the 6-year period liver mortality was from 33.4/10^5 to 29.8/10^5 in males and from 16.0/10^5 to 11.4/10^5 in females (Table 2). The APC of liver mortality was not significant in either gender (Table 2).

Lung cancer

During the 6 years, the average age-standardized rate of lung cancer mortality was 28.43/10^5 in males and
Table 1. The Comparison of Main Cancer Mortalities (/10^5) in Yanting 2004-2009 and Average Figures (/10^5) in China and Worldwide in 2008*

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Total cancer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>172.39</td>
<td>158.6</td>
<td>128.8</td>
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<tr>
<td>female</td>
<td>91.05</td>
<td>91.6</td>
<td>87.6</td>
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<td>EC</td>
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<td></td>
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<tr>
<td>male</td>
<td>54.68</td>
<td>18.7</td>
<td>8.6</td>
</tr>
<tr>
<td>female</td>
<td>31.60</td>
<td>8.2</td>
<td>3.4</td>
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<td>Gastric cancer</td>
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<td></td>
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<tr>
<td>male</td>
<td>43.62</td>
<td>30.1</td>
<td>14.3</td>
</tr>
<tr>
<td>female</td>
<td>22.43</td>
<td>14.6</td>
<td>6.9</td>
</tr>
<tr>
<td>Liver cancer</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>28.66</td>
<td>34.1</td>
<td>14.6</td>
</tr>
<tr>
<td>female</td>
<td>10.85</td>
<td>13.1</td>
<td>5.7</td>
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<tr>
<td>Lung cancer</td>
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<tr>
<td>male</td>
<td>28.43</td>
<td>39.6</td>
<td>29.4</td>
</tr>
<tr>
<td>female</td>
<td>10.15</td>
<td>18.3</td>
<td>11.0</td>
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</tbody>
</table>

* The cancer mortalities of China and World were obtained from International Agency for Research on Cancer (International Agency for Research on Cancer, 2010)

Table 2. Age-standardized rate of cancer mortality (/10^5) and annual percentage changes in Yanting County, 2004-2009

| Cancer Sites | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  | APCh(%)
|--------------|------|------|------|------|------|------|------|
| Total cancer | 156.3 | 155.3 | 154.3 | 153.3 | 152.3 | 151.3 | -0.5%
| Male         | 43.7 | 43.8 | 43.9 | 44.0 | 44.1 | 44.2 | -0.5%
| Female       | 112.6 | 111.5 | 110.4 | 109.3 | 108.2 | 107.1 | -1.0%
| EC           | 51.9 | 52.0 | 52.1 | 52.2 | 52.3 | 52.4 | -0.5%
| Male         | 65.1 | 65.2 | 65.3 | 65.4 | 65.5 | 65.6 | -0.5%
| Female       | 42.2 | 42.3 | 42.4 | 42.5 | 42.6 | 42.7 | -0.5%
| Gastric cancer | 40.9 | 41.0 | 41.1 | 41.2 | 41.3 | 41.4 | -0.5%
| Male         | 56.5 | 56.6 | 56.7 | 56.8 | 56.9 | 57.0 | -0.5%
| Female       | 27.0 | 27.1 | 27.2 | 27.3 | 27.4 | 27.5 | -0.5%
| Liver cancer | 25.2 | 25.3 | 25.4 | 25.5 | 25.6 | 25.7 | -0.5%
| Male         | 33.4 | 33.5 | 33.6 | 33.7 | 33.8 | 33.9 | -0.5%
| Female       | 15.9 | 16.0 | 16.1 | 16.2 | 16.3 | 16.4 | -0.5%
| Lung cancer  | 15.6 | 15.7 | 15.8 | 15.9 | 16.0 | 16.1 | -0.5%
| Male         | 22.6 | 22.7 | 22.8 | 22.9 | 23.0 | 23.1 | -0.5%
| Female       | 7.8  | 7.9  | 8.0  | 8.1  | 8.2  | 8.3  | -0.5%

* The cancer mortalities of China and World were obtained from International Agency for Research on Cancer (International Agency for Research on Cancer, 2010)
2008: 30.1/10^5 in males and 14.6/10^5 in females, but much higher the worldwide figures (International Agency for Research on Cancer, 2010). Therefore, though Yanting was not a high risk area for gastric cancer in China, compared with worldwide average it was a high risk area of gastric cancer probably. Gastric cancer mortality in 2004 was 41.0/10^5 and in 2009 it changed to 30.4/10^5. But the annual percentage change of gastric cancer mortality did not reach a statistical significance: during the 6-year period, gastric cancer mortality was stable. This result was not consistent with the reports from China Ministry of Health, which indicated that from 1987 to 1999, gastric cancer mortality significantly but slightly declined based on the survey among 10% of Chinese population (Yang, 2003; Yang et al., 2003). The reducing trend of gastric cancer incidence was also founded in Qidong from 1978-2002 (Chen et al., 2006). As indicated, improved socio-economic status with the reports of China Ministry of Health, which indicated that from 1987 to 1999, gastric cancer mortality significantly but slight declined based on the survey among 10% of Chinese population (Yang, 2003; Yang et al., 2003). The reducing trend of gastric cancer incidence was also founded in Qidong from 1978-2002 (Chen et al., 2006). As indicated, improved socio-economic status and lifestyle might be responsible for the declining risk of gastric cancer (Yang et al., 2003). H. pylori infection, the sufficient carcinogen to gastric cancer by IARC, was related to the socioeconomic status too (Parkin et al., 2005). Since Yanting had a notable socio-economic status improvement, the non-significant change of gastric cancer mortality in Yanting was possibly resulted from short-term observation. It was necessary to explore the trend of gastric cancer mortality in a longer period. Yanting was not an area with higher liver cancer mortality in China: liver cancer mortality in Yanting was 28.7/10^5 in males 10.8/10^5 in females in the 6-year period, and in China the corresponding figures were 34.1/10^5 and 13.1/10^5 in 2008 (International Agency for Research on Cancer, 2010). But in terms of the worldwide liver cancer mortality, the mortality of liver cancer was much higher (International Agency for Research on Cancer, 2010). Despite the change of liver cancer mortality from 25.2/10^5 to 20.6/10^5 during the 6-year period, the difference did not get statistical significance. And the 95% confidence interval for annual percentage change was too wide: from -15.2% to 12.9%.

Worldwide, because of the poor prognosis, the death number of liver cancer was almost the same during recent decades (Parkin et al., 2005). Italian Network of Cancer Registries reported that liver cancer mortality was stable during 1986-1997, though increased incidence of liver cancer had been documented (Ferretti et al., 2004). From the reports of China Ministry of Health, the trend of liver cancer mortality was opposite in rural and urban areas: in rural areas the annual increase rate of mortality was 1.0% in females, but not significant in males; in urban areas 1.0% of mortality reduced annually in males, but in females no significant change was observed (Yang et al., 2003). Both infection with hepatitis B virus and dietary aflatoxin exposure were the major etiological determinants of the high rates of liver cancer in China (Yang et al., 2003; Parkin et al., 2005). Vaccination for hepatitis B virus infection had been promoted since 2002, so the declines of incidence and mortality of liver cancer could not be observed in 2004-2009 (Parkin et al., 2005). The non-significant change of liver cancer mortality might result from the stable exposure to risk factors in Yanting region. Furthermore, it would be expected to take a longer time to see the beneficial effects of hepatitis B vaccination promotion in China.

In Yanting, male average lung cancer mortality was 28.4/10^5 and female average mortality was 10.2/10^5 and the average figures of China was 39.6/10^5 in males and 18.3/10^5 in females in 2008 (International Agency for Research on Cancer, 2010). The challenge of lung cancer to Yanting population is increasing in future. Some actions needed to be taken to cope with the upward challenge of lung cancer in Yanting. Lung cancer was the most common cancer and the most common death cause from cancer worldwide (Parkin et al., 2005). In Yanting area, from 2004 to 2009, lung cancer mortality increased to 26.1/10^5 from 15.6/10^5, with annual increase rate higher than 10% in both genders.

The lung cancer mortality had been significantly increased in US from 1975-1990 in both genders; since 1990 the corresponding figure had began to decline in males, but in females it still had been in an upward trend (Jemal et al., 2008). And across the whole China, lung cancer mortality increased significantly from 1987 to 1999 (Yang et al., 2003). Tobacco smoking was considered as major contributor to lung cancer, which influenced the geographic and temporal patterns of lung cancer incidence and mortality and accounted for more than 80% of lung cancer (Parkin et al., 2005; Boyle et al., 2008). From 1991 to 2001 the production of cigarettes in China increased by 2 million boxes (National Bureau of Statistics of China, 2002) and the sale rate was up to 99.3% (National Bureau of Statistics of China, 2002). In China 67% of males were smokers, but the proportion in females was only 4% (Peto et al., 2009). The increased mortality of lung cancer in Yanting was consistent with the upward consumption of tobacco in China. Despite the relatively low proportion of female smokers, lung cancer mortality in women living in Yanting still proved to be increased, which might be the consequence of elevated exposure to second hand tobacco smoking as well as other forms of environmental pollution.

Summarily, in China, Yanting was a high risk area for EC but not other cancers, but worldwide gastric and liver cancer mortalities were both much higher than average figures. And in the 6-year observation, it failed to get a significant decline trend for the mortalities of all cancers and liver cancer. But for Esophageal cancer, the mortality was processing a downward trend. And it was possible to see a significantly reducing tendency for gastric cancer mortality in a longer observation period. On the contrary, lung cancer mortality had a significantly increase tendency: the annual increase rate was higher than 10%. From the worldwide perspectives, Yanting was a high risk area for upper gastrointestinal cancers (esophagus, stomach and liver), and it called for an action to figure out their risk factors and some interventions to address their burdens.

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Major Cancer Mortality and Time Change in Yanting, 2004-2009: Cancer Challenges in a High Risk Area

References


