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# An analysis: Colon cancer mortality in Tianjin, China, from 1981 to 2000

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## Abstract

**AIM:** To analyze the data from Tianjin Cancer Registry of mortality due to colon cancer from 1981 to 2000 in Tianjin, China.

**METHODS:** Tumors diagnosed in this study were coded according to ICD-9. Mortality rates were calculated by sex and calendar year of diagnosis.

**RESULTS:** Seventy point four percent of colon cancer deaths occurred in the age group of 55-79 years and the mortality rate reached its peak in the age group of 75-80 years. The average age at death was 64.10 years. An ascending trend was observed in the mean age of death due to colon cancer from 1981 through 2000. However, as for the sex ratio, there was no clear trend exhibited. During 1981-2000, the total number of deaths was 2147, 1041 males and 1106 females. The mean mortality rate of colon cancer was 3.04/100 000. The mortality caused by colon cancer ascended from 1981 to 2000.

**CONCLUSION:** The epidemic trend of colon cancer in Tianjin and its risk factors and prevention should be studied further.

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**Key words:** Colon cancer; Mortality trend; Cancer registry

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## INTRODUCTION

Colon cancer and rectum cancer are distinct to some extent in their epidemiology<sup>[1,2]</sup>. Colon cancer is one of the

most common cancers in the Western and industrialized nations<sup>[3-6]</sup>. By the year 1996, it had remained an important subject of research in China for more than 20 years. Mortality due to colon cancer has increased gradually, partly as a result of the changes of life style and nutrition. From the early 1970s to the late 1980s, the highest rate of increase in cancer was observed in colon cancer<sup>[7]</sup>. Therefore, it appears especially critical to gather and analyze the data concerning the incidence and mortality of colon cancer. This study analyzed the data about the mortality as a result of colon cancer in the urban areas of Tianjin during 1981-2000. The results provide insights into the etiology and prevention of colon cancer.

## MATERIALS AND METHODS

### Cancer deaths

The data concerning cancer mortality were provided by Tianjin Cancer Registry. As mandated by Tianjin Health Bureau, it is the duty of the medical institutions to fill cards to report their individual cancer cases to Tianjin Cancer Registry. The cards should include the name, birthday, gender, address, tumor site, date of diagnosis, age at diagnosis, diagnostic method of cases, and the date and age at death for cases to be registered. The Registry is responsible for the coding, checking, sorting, and analyzing of the reported cards. As for cases with information omissions, family visits were made to compensate for such lost data. Cases in this study were constant inhabitants in urban Tianjin, coded according to ICD-9.

### Population data

Tianjin Public Safety Bureau provided the population data.

### Statistical analysis

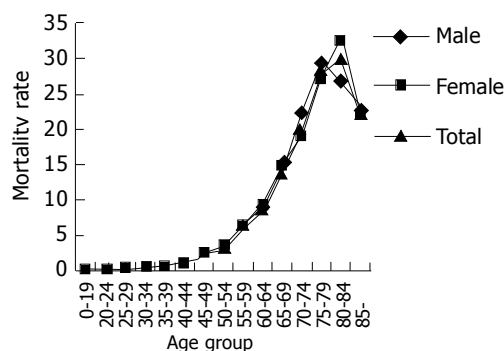
Software packages SAS 8.0 and SPSS 10.0 were employed to calculate the mortality rate, standardized rate, and mean age at death. A linear regression model was established for the trend of mortality.

## RESULTS

### Age distribution of mortality

A total of 2 147 cards were reported during 1981-2000 concerning dead cases of colon cancer, all of which included a definite age at death. The number of deaths increased with age among people under 55 years, but decreased for those over 75 years. The group aged between 55 and 79 years accounted for 70.4% of the total cases. Mortality rates varied greatly among different age groups, increasing

moderately and remaining at a relatively low level before reaching age 50, but increased dramatically after 50 years of age and reached its peak after 70-80 years of age (Table 1, Figure 1).



**Figure 1** Age-specific rate of colon cancer mortality in Tianjin, from 1981 to 2000.

**Table 1** Age distribution of colon cancer mortality in Tianjin during 1981-2000

Age at death	Male			Female			Total		
	Death prop (%) rate			Death prop (%) rate			Death prop (%) rate		
0-	2	0.2	0.02	2	0.2	0.02	4	0.2	0.02
20-	4	0.4	0.14	4	0.4	0.15	8	0.4	0.14
25-	15	1.4	0.43	8	0.7	0.24	23	1.1	0.34
30-	25	2.4	0.69	21	1.9	0.60	46	2.1	0.64
35-	29	2.8	0.83	23	2.1	0.67	52	2.4	0.75
40-	32	3.1	1.10	31	2.8	1.07	63	2.9	1.08
45-	48	4.6	2.10	63	5.7	2.71	111	5.2	2.41
50-	58	5.6	2.99	68	6.1	3.39	126	5.9	3.19
55-	115	11.0	6.53	119	10.8	6.37	234	10.9	6.44
60-	143	13.7	9.11	145	13.1	8.70	288	13.4	8.88
65-	166	15.9	13.27	190	17.2	14.85	356	16.6	14.05
70-	187	18.0	22.12	164	14.8	18.77	351	16.3	20.40
75-	139	13.4	29.31	145	13.1	27.44	284	13.2	28.29
80-	58	5.6	26.83	90	8.1	32.64	148	6.9	30.07
85-	20	1.9	22.47	33	3.0	21.86	53	2.5	22.07
Total	1041	100.0	2.92	1106	100.0	3.15	2147	100.0	3.04

Prop: proportion; rate: 1/100 000.

### Trend for mean age at death

The average age at death during 1981-2000 was 64.10 years (male: 63.57 years; female: 64.59 years), which was higher in females than in males, but the difference was statistically insignificant between sexes. The mean age at death (from 62.85 years in 1981 to 66.61 years in 2000) increased by 3.76 years during the two decades. This trend was almost the same for both the sexes. Linear regression further confirmed this trend (Tables 2, 3 and Figure 2A).

### Trends for sex ratio of colon cancer mortality

Sex ratio of colon cancer mortality fluctuated around 1.0 during 1981-2000, ranging from 0.65 in 1984 to 1.40 in 1991, but no clear trend was observed in these 20 years. Linear regression model was statistically insignificant:  $t = 1.622$ ,  $P = 0.122$  (Tables 4, 5 and Figure 2B).

### Mortality rate and its trend

Two thousand one hundred and forty-seven new colon cancer deaths were reported in Tianjin during 1981-2000 of which 1041 were male and 1106 were female. Mortality rates of colon cancer were calculated on the basis of population data and the corresponding number of new deaths reported. The average crude mortality rate over these 20 years was 3.04/100 000 (male: 2.92/100 000; female: 3.15/100 000), while the average age standardized rate was

**Table 2** Trend of mean age at death due to colon cancer in Tianjin, from 1981 to 2000

Year	Male			Female			Total		
	Mean	SD	SE	Mean	SD	SE	Mean	SD	SE
1981	58.70	13.94	2.20	66.31	8.48	1.22	62.85	11.85	1.26
1982	57.81	16.49	2.92	64.42	14.24	2.17	61.60	15.49	1.79
1983	59.12	11.69	1.83	64.15	14.14	1.83	62.11	13.37	1.33
1984	59.53	16.50	2.92	59.00	16.86	2.43	59.21	16.61	1.86
1985	62.64	12.63	1.84	61.75	16.66	2.63	62.23	14.54	1.56
1986	59.28	15.70	2.31	62.76	12.37	1.67	61.18	14.02	1.40
1987	57.63	16.24	2.40	62.49	13.36	2.14	59.86	15.10	1.64
1988	63.57	10.99	1.70	60.56	12.28	1.74	61.93	11.75	1.22
1989	61.65	14.97	2.04	62.04	15.03	2.22	61.83	14.92	1.49
1990	63.85	13.50	1.87	63.78	13.71	1.87	63.81	13.54	1.32
1991	63.39	13.04	1.73	65.75	12.06	1.91	64.36	12.63	1.28
1992	64.65	12.88	1.84	65.05	12.30	1.62	64.87	12.51	1.21
1993	67.83	10.77	1.49	64.16	13.25	1.62	65.76	12.32	1.13
1994	64.17	12.16	1.38	65.89	12.91	1.48	65.02	12.53	1.01
1995	65.13	12.85	1.56	65.07	11.20	1.50	65.10	12.09	1.09
1996	65.21	12.25	1.50	65.81	11.99	1.56	65.49	12.08	1.08
1997	64.56	14.19	1.80	69.82	12.56	1.47	67.41	13.54	1.17
1998	67.41	10.90	1.40	65.19	11.66	1.48	66.29	11.30	1.02
1999	68.06	13.44	1.67	66.29	13.51	1.63	67.15	13.45	1.16
2000	67.22	11.69	1.65	66.13	14.79	1.86	66.61	13.46	1.27
Total	63.57	13.52	0.42	64.59	13.31	0.40	64.10	13.42	0.29

Comparison of mean age at death between sexes:  $t = -1.75$ ,  $P = 0.0796$ .

**Table 3** Linear regression analyses for mean age at death of colon cancer

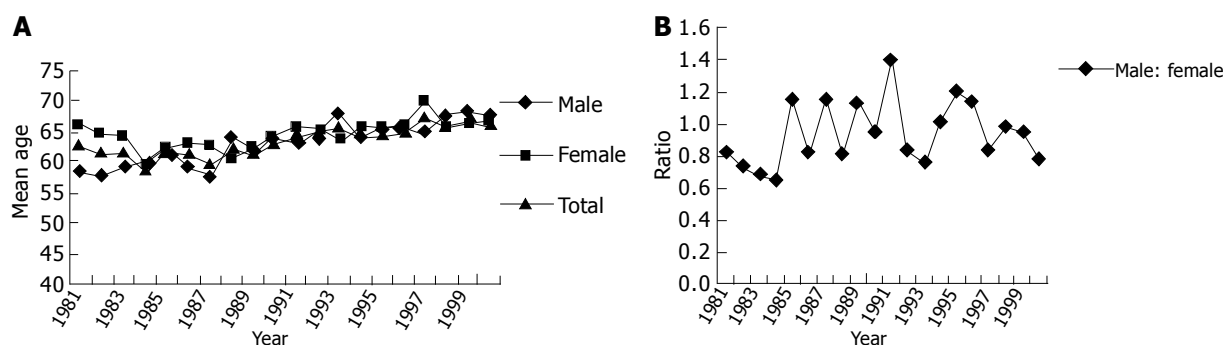
Year of diagnosis	B	SE	STD B	t	P	95%CI
Male	0.436	0.050	0.900	8.735	0.000	0.331, 0.541
Female	0.237	0.060	0.683	3.970	0.001	0.112, 0.363
Total	0.336	0.042	0.882	7.943	0.000	0.247, 0.425

**Table 4** Trend for sex ratio of colon cancer mortality in Tianjin from 1981 to 2000

Year	Ratio	Year	Ratio	Year	Ratio	Year	Ratio
1981	0.81	1986	0.82	1991	1.40	1996	1.13
1982	0.73	1987	1.15	1992	0.83	1997	0.84
1983	0.67	1988	0.82	1993	0.77	1998	0.98
1984	0.65	1989	1.15	1994	1.01	1999	0.94
1985	1.15	1990	0.94	1995	1.20	2000	0.79

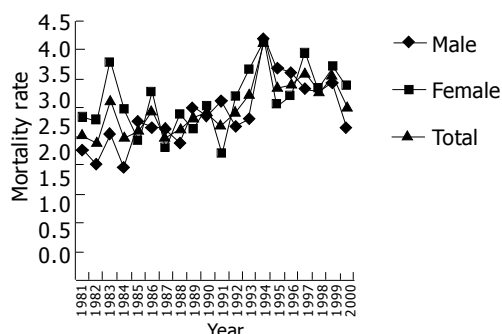
**Table 5** Linear regression analyses for sex ratio of colon cancer mortality

Variable	B	SE	STD B	t	P	95%CI
Year of diagnosis	8.857E-03	0.008	0.260	1.140	0.269	-0.007, 0.025



**Figure 2** Trend for mean age (A) and sex ratio (B) of colon cancer mortality in Tianjin from 1981 to 2000.

2.49/100 000 (male: 2.49/100 000; female: 2.48/100 000). The difference is statistically insignificant between sexes. Linear regression takes the year of death as independent variable and mortality rate as dependent variable that suggests an ascending trend apparent in colon cancer mortality during 1981-2000 (from 2.55/100 000 in 1981 to 3.02/100 000 in 2000) representing about a 18.43% increase over these 20 years, annually 0.89% (Tables 6, 7 and Figure 3).



**Figure 3** Mortality trend of colon cancer in Tianjin during 1981-2000.

**Table 6** Mortality rate of colon cancer in Tianjin during 1981-2000

Year	Male			Female			Total		
	Deaths	Rate	ASR	Deaths	Rate	ASR	Deaths	Rate	ASR
1981	40	2.28	2.55	48	2.83	3.10	88	2.55	2.78
1982	32	2.03	2.07	43	2.78	2.81	75	2.40	2.49
1983	41	2.55	2.56	60	3.80	3.71	101	3.17	3.21
1984	32	1.95	1.93	48	2.98	2.88	80	2.46	2.43
1985	47	2.78	2.75	40	2.42	2.22	87	2.61	2.49
1986	46	2.68	2.43	55	3.28	3.04	101	2.97	2.77
1987	46	2.64	2.32	39	2.29	2.01	85	2.47	2.18
1988	42	2.37	2.08	50	2.89	2.64	92	2.63	2.36
1989	54	3.01	2.92	46	2.62	2.26	100	2.82	2.51
1990	52	2.86	2.48	54	3.03	2.49	106	2.94	2.49
1991	57	3.12	2.59	40	2.23	1.77	97	2.68	2.19
1992	49	2.67	2.30	58	3.21	2.44	107	2.94	2.35
1993	52	2.82	2.24	67	3.68	2.74	119	3.24	2.52
1994	78	4.21	3.24	76	4.15	2.98	154	4.18	3.11
1995	68	3.67	2.84	56	3.05	2.14	124	3.36	2.46
1996	67	3.62	2.64	59	3.21	2.42	126	3.41	2.53
1997	62	3.35	2.47	73	3.97	2.58	135	3.66	2.55
1998	61	3.27	2.35	62	3.35	2.19	123	3.31	2.24
1999	65	3.48	2.42	69	3.72	2.36	134	3.60	2.38
2000	50	2.66	1.77	63	3.38	2.09	113	3.02	1.92
Total	1 041	2.92	2.49	1 106	3.15	2.48	2 147	3.04	2.49

Comparison of mean mortality between sexes:  $\chi^2 = 0.075$  (df = 2145),  $P > 0.05$ .

**Table 7** Parameter estimation for linear regression of colon cancer mortality

Year of diagnosis	B	SE	STD B	t	P	95% CI
Male	6.880E-02	0.016	0.709	4.267	0.000	0.035, 0.103
Female	4.294E-02	0.019	0.469	2.252	0.037	0.003, 0.083
Total	5.598E-02	0.013	0.702	4.185	0.001	0.028, 0.084

## DISCUSSION

As shown in this study, 2147 new deaths of colon cancer were reported in Tianjin from 1981 to 2000. The average age-standardized mortality rate during the two decades was 2.49/100 000 (2.49/100 000 for males and 2.48/100 000 for females). Available reports suggest that the highest mortality rate of colon cancer for males was 17.1/100 000 observed in Hungary, and 14.2/100 000 for females in New Zealand during 1988-1992<sup>[8]</sup>. Both were approximately six times the rates in Tianjin.

Although colon cancer mortality in Tianjin is insignificant in comparison with that of industrialized nations, it had experienced an 18.43% increase over these 20 years, a growth from 2.55/100 000 in 1981 to 3.02/100 000 in 2000. Certain Western countries have already made progress in controlling colon cancer. For example, in Canada, colon cancer mortality decreased from 13.9/100 000 to 13.1/100 000 for males and from 11.9/100 000 to 9.4/100 000 for females during the 1980s. In the same period, the Swedish colon cancer mortality descended from 10.4/100 000 to 9.9/100 000 for males and from 9.1/100 000 to 8.1/100 000 for females<sup>[9]</sup>. Therefore, the trend of colon cancer mortality is apparently unfortunate in Tianjin. It is imperative to curb the pace of such an increase in colon cancer deaths for the sake of humanity.

Although the constant increase in colon cancer mortality may be directly due to the increase in colon cancer incidence, it may be that its primary cause is the change in lifestyle and environment. A large body of evidence indicated that several dietary and lifestyle factors were likely to have a major influence on the risk of colon cancer. Physical inactivity, excess body weight, and a central deposition of adiposity are consistent risk factors. Over-consumption of energy is likely to be one of the major contributors to the high incidence rates of colon cancer in Western countries. Red meat, processed meats, and perhaps refined carbohydrates could contribute to the risk<sup>[8]</sup>. Immigrant epidemiology can well establish the relation between environment and colon

cancer incidence. For example, Blacks in America have 10-20 times more incidence than Blacks in Africa. Male and female American Chinese have an incidence of 10 times and 3-4 times, respectively than those in Shanghai<sup>[10]</sup>.

This study also showed that the mortality of colon cancer was only slightly higher in females than in males, and this difference was statistically insignificant. Trend analysis for sex ratio showed no clear change in sex distribution of colon cancer mortality, suggesting that males and females share almost the same risk of dying of colon cancer. On the other hand, age distribution analysis found that older people had a higher mortality rate than younger people, especially after age 50, the mortality rate increased exponentially. The group aged 55-79 years accounted for 70.4% of total deaths. Trend analysis for mean age at death proposed an even worse situation for the old, since the mean age has been increasing. Then, it is self-evidently true that the older people are the high-risk group of colon cancer mortality. In such cases, in addition to effective treatment for colon cancer, screening of the group with high risk would be effective to prevent potential deaths of colon cancer. It has been reported that annual fecal occult blood tests can reduce the incidence and mortality rate of colorectal cancer<sup>[11-13]</sup>. Furthermore, there is evidence that screening not only reduces the incidence of colorectal cancer, but also the mortality, which is substantially reduced after removal of the precursor lesions<sup>[14,15]</sup>.

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