Colorectal Cancer Incidence Trends by Subsite in Urban Shanghai, 1972–1994

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Abstract

Epidemiological characteristics of colorectal cancer may differ by particular anatomical subsite, suggesting that the subsite-specific colorectal cancers may represent different disease entities. This study explored the time trends over a 23-year period in colorectal cancer incidence at various subsites by sex and age group. Data on the incidence of colorectal cancer were obtained from a population-based cancer registry in Shanghai, People's Republic of China. Between 1972 and 1994, 30,693 patients with colorectal cancer were registered at the Shanghai Cancer Registry. The overall age-adjusted colorectal cancer incidence rates increased >50%, or 2% per year from 1972–1977 to 1990–1994, from 14 to 22 per 100,000 among men and from 12 to 19 per 100,000 among women. The increases in rates were considerably more rapid for colon cancer, with rates approximately doubling, than they were for rectal cancer. Proximal colon cancer was more common than distal colon cancer over the whole study period, whereas rates for both cancers rose with similar annual percentage changes (>5% per year) and across virtually all age groups. The estimated annual increases rose from 2% at ages 35–44 years to 7% at ages 75–84 years for proximal colon cancer, but they were more uniform for distal colon cancer (5–6% per year). Age-adjusted and age-specific rectal cancer rates changed little. The male:female age-adjusted rate ratio for colorectal cancer was 1.19 in 1990–1994. The ratios increased over time and varied by subsites, with ratios increasing from the proximal colon to the distal colon and to the rectum. Furthermore, men had higher rates than women for distal colon and rectal cancers at ages 55 and older, whereas women had higher rates than men at younger ages for these two cancers. Male:female rate ratios for proximal colon cancer did not vary substantially with age. The findings from this study indicate that subsite-specific incidence rates of colorectal cancer differ by sex and age and in their time trends. Cancers arising in the proximal colon, distal colon, and rectum may have somewhat different disease etiologies.

Introduction

Although the incidence and mortality rates of colorectal cancer are higher in Western Europe, North America, and Australia than in Asia, Africa, and Latin America (1, 2), the rates have been increasing rapidly in some low incidence areas, such as Asia (3, 4). Large variations in colorectal cancer incidence by subsite have been seen in high-risk areas (5–8). Subsite-specific etiological patterns for colorectal cancers have been proposed (9). In Shanghai, People's Republic of China, during the past two decades, the colon cancer incidence rates have been rising consistently, whereas the increases in rectal cancer rates have been small (10). Using population-based cancer registry data in urban Shanghai, we updated the incidence trends and examined incidence patterns by anatomical subsite of origin and demographic characteristics.

Materials and Methods

Data sources and methods have been described in detail elsewhere (11). Briefly, the population-based Shanghai Cancer Registry, which covered a population of 7.3 million in 1992, has collected information concerning all incident cancer cases diagnosed among residents since 1972. This study was restricted to the 10 urban districts of Shanghai (henceforth referred to as Shanghai) for which population information was available for the entire time period of 1972–1994. Cancer cases were coded according to the ninth revision of the International Classification of Diseases (12). All cancers of the colon (International Classification of Diseases codes 153.0–153.9) and rectum (154.0–154.8) were included in the analyses. For subsite-specific analyses, colon cancer was grouped into the proximal colon (*i.e.*, cancers arising in the cecum, appendix, ascending colon, hepatic flexure, transverse colon, and splenic flexure) and distal colon (*i.e.*, cancers arising in the descending colon and sigmoid colon). Rectal cancer included those arising from the rectosigmoid junction and rectum. Population estimates were based on periodic censuses, with age- and sex-specific annual estimates derived by linear inter- and extrapolation for the remaining years. Age-specific (5 years) incidence rates per 100,000 person-years were calculated for the three 6-year periods (1972–1977, 1978–1983, and 1984–1989) and one 5-year period (1990–1994). Rates for each period were age-adjusted to the world standard population by the direct method using 5-year age groups (1). Annual percentage changes in incidence were estimated by means of a linear regression of the logarithm of the respective rates on calendar year, weighted by the number of cases.

Results

During the 23-year study period, 30,693 cases of colorectal cancer were diagnosed among permanent residents of Shang-

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Table 1 Colorectal cancer incidence rates[a] in urban Shanghai, 1972–1994

	1972–1977		1990–1994		% change	APC[b]
	No.	Rate	No.	Rate		
Males						
Colorectum	2296	14.0	5251	22.1	57.7	2.5[c]
Colon	1008	6.1	2978	12.5	105.2	4.1[c]
Proximal	334	1.9	1198	5.0	164.7	5.3[c]
Distal	241	1.4	984	4.1	186.9	5.6[c]
Not specified	433	2.8	796	3.4	21.6	1.1
Rectum	1288	7.9	2273	9.6	21.1	1.0
Females						
Colorectum	2343	12.3	4854	18.5	51.3	2.3[c]
Colon	1100	5.8	2936	11.2	94.1	3.8[c]
Proximal	364	1.9	1239	4.8	149.8	5.1[c]
Distal	268	1.4	938	3.6	161.4	5.3[c]
Not specified	468	2.5	759	2.8	13.6	0.8
Rectum	1243	6.5	1918	7.4	13.4	0.6

[a] Per 100,000 person-years, directly age-adjusted using the world standard.
[b] APC, Annual percentage change.
[c] $P < 0.05$.

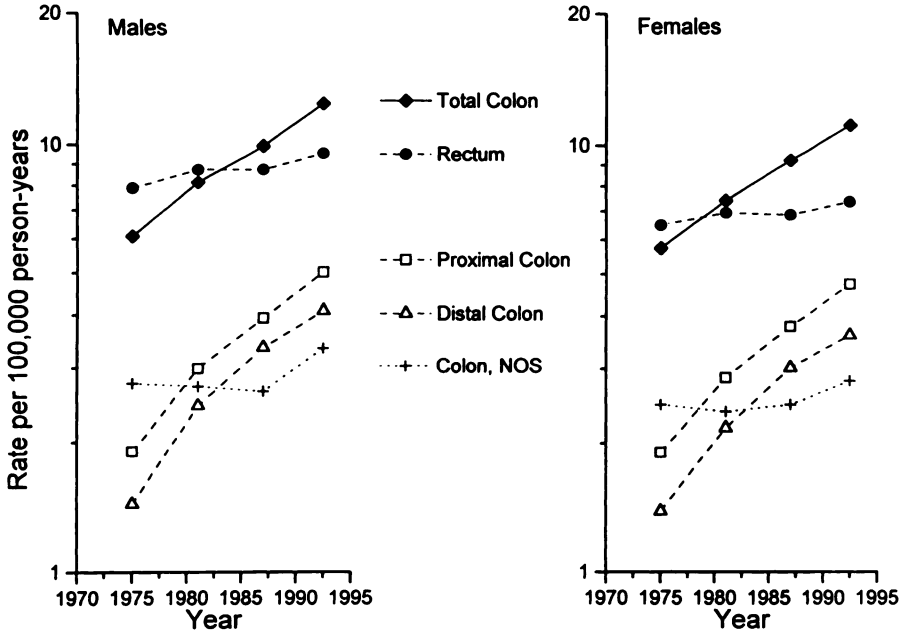

Fig. 1. Age-adjusted colorectal cancer incidence trends in Shanghai, 1972–1977 to 1990–1994.

hai. Rates increased >50%, or 2% per year from 1972–1977 to 1990–1994, from 14 to 22 per 100,000 among men and from 12 to 19 per 100,000 among women (Table 1). The rate of increase was considerably more rapid for colon cancers, with rates about doubling, than it was for rectal cancers (Fig. 1). During the 1970s, rectal cancer was more common than colon cancer, but it has been surpassed by colon cancer since the 1980s. When considered by subsite, rates for both proximal and distal colon cancers increased at >5% per year among both men and women. Rates for proximal colon have been consistently higher than those for distal colon among both sexes. The proportion of colon cancers that did not have the subsite specified declined from 43% in the early years (1972–1977) to 26–27% in recent years (since the mid-1980s).

Among men, proximal colon rates rose across virtually all ages, with the rates of increase larger with each successive age group: from 35% at ages 35–44 to 95%, 156%, 200%, and 377% at ages 75–84; the corresponding annual percentage increases rose from 2% to 7% per year (Fig. 2*a*). Increases in distal colon cancer rates appeared more uniform, ranging between 5 and 6% per year. Rectal cancer rates did not change as dramatically by age, although the increases exceeded 2% per year among those of ages 65–74 years. Among women, rates also rose rapidly for all age groups for both proximal and distal colon cancers, in contrast to much more modest changes for rectal cancer (Fig. 2*b*).

The male:female age-adjusted rate ratio for colorectal cancer rose from 1.14 during 1972–1977 to 1.19 during 1990–1994. The ratios for each cancer subsite generally increased over time and from the proximal to the distal colon and to the rectum during each time period (Table 2). Age-specific proximal colon cancer rates were similar among men and women,

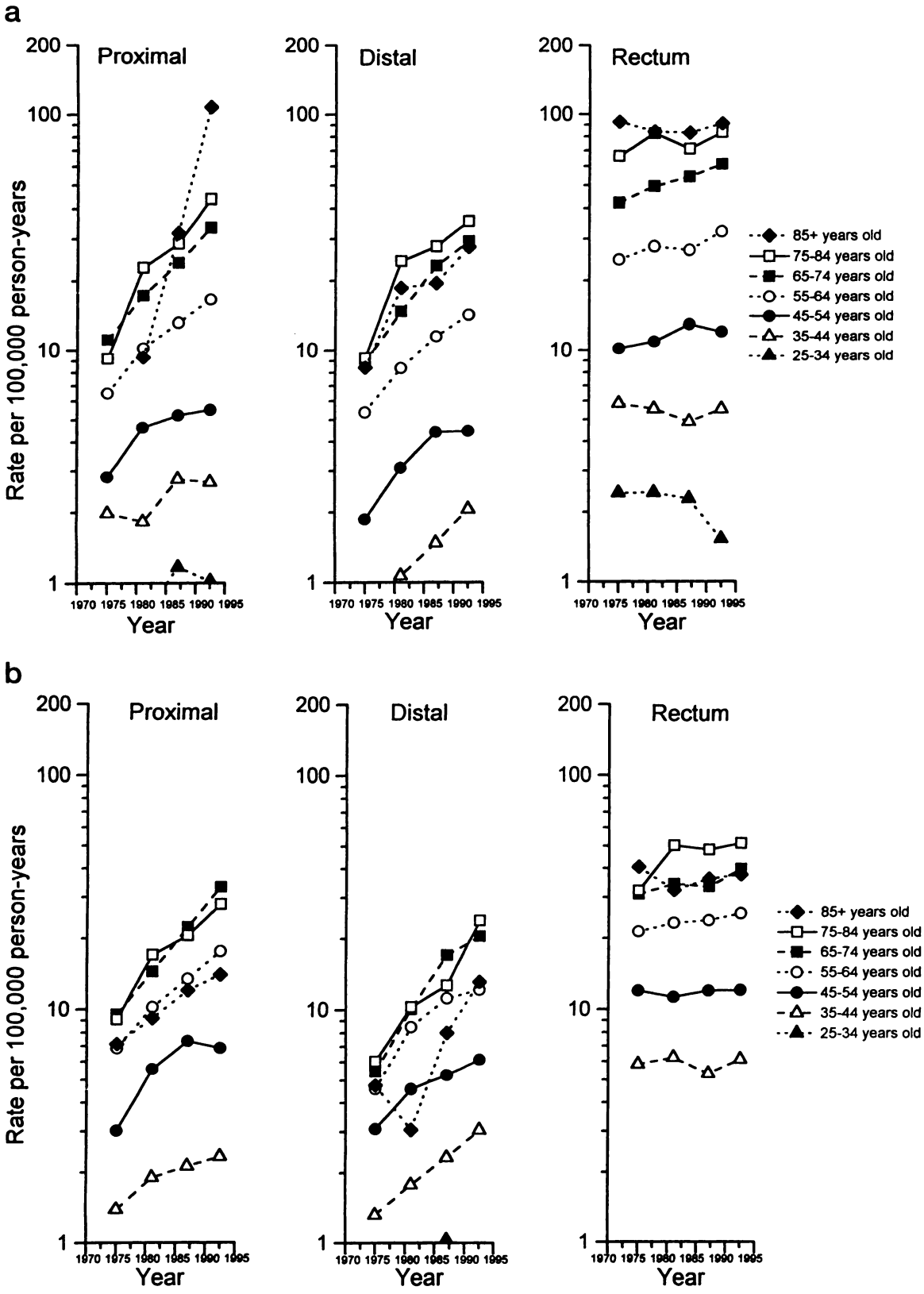

Fig. 2. Age-specific colorectal cancer incidence trends in Shanghai, 1972–1977 to 1990–1994. *a*, males; *b*, females.

Table 2 Male:female rate ratios for colorectal cancer in urban Shanghai, 1970–1994

	Proximal colon	Distal colon	Rectum
Age-adjusted rate ratios			
1972–1977	1.00	1.04	1.22
1978–1988	1.05	1.12	1.26
1984–1989	1.04	1.11	1.27
1990–1994	1.06	1.14	1.30
Age-specific rate ratios during 1990–1994			
15–24	1.07	—[a]	0.65
25–34	1.26	0.45	0.80
35–44	1.15	0.68	0.90
45–54	0.80	0.73	1.00
55–64	0.95	1.17	1.26
65–74	1.01	1.42	1.54
75–84	1.57	1.48	1.62
>85	7.69	2.12	2.42

[a] —, no incident cases among women and 3 cases among men.

with an excess among men suggested only in recent years at older ages (Fig. 3), whereas the ratios monotonically increased with age for both distal colon and rectal cancers (Table 2). The rates for distal colon and rectal cancers were higher among men than women at ages 55 and older, but they were higher among women than men at younger ages, particularly for distal colon cancer (Fig. 3).

Discussion

Our results indicated that the incidence rates for colon cancer have doubled during the 23-year period since 1972. The rates for the proximal colon were higher than those for the distal colon, with almost parallel increasing trends among both men and women. The increase in incidence became larger with each successive age group, especially for proximal colon cancer. Increases in rates for rectal cancer were modest and varied little across age groups. The male:female sex ratios for colorectal cancers increased over time and from the proximal to the distal colon and to the rectum. Moreover, men had higher rates for distal colon and rectal cancers at ages ≥55 years, whereas at younger ages, the rates were higher in women than men.

Part of the increases in proximal and distal colon cancer rates could be related to improvements in diagnostic specificity because colon cancers with unspecified subsite declined from 43% in 1972–1977 to 26–27% after the mid-1980s. The percentages of colon cancers with subsite not specified were the same for men and women and did not vary with age in our study. Thus, changes in the proportion of colon cancers with unclassified subsite were unlikely to have substantial influence on the subsite incidence patterns. Case ascertainment criteria and registry procedures also have not changed over time. The more rapid increases in proximal colon cancer rates among the older age groups than the younger age group may suggest improving case diagnosis among the elderly. Although increased use of screening and early detection procedures, such as fecal occult blood test, sigmoidoscopy, and colonoscopy, may have contributed to the trends, the impact is likely to have been minimal because screening for colorectal cancers is still uncommon in Shanghai. Unfortunately, we were not able to find any information on screening of colorectal cancer in Shanghai to evaluate the impact on the rates of colorectal cancers. Screening or early detection of colorectal cancer should be more effective in the diagnosis of distal colon and rectal cancers than proximal colon cancer, thus leading to a steeper rise in distal colon or rectal cancers compared with that in proximal cancer, which was not seen. Therefore, the rising rates for proximal and distal colon cancers are likely to be mostly real.

The increasing adoption of a Western lifestyle, particularly in dietary habits, is probably the most important factor contributing to the rapid rise in colon cancer incidence among Shanghai residents. The consumption of animal foods increased 50–160% in China during the two-decade period 1954–1979 (13), and the intake of meat, fish, eggs, fats and oil, and total dietary fat tended to be higher in the Shanghai population than that in China overall (14). In addition, physical activity levels have declined in the urban population in China (15). High intake of dietary fat and animal foods and low physical activity, well-established risk factors for colon cancer in Western societies (16), have been associated with colon cancer risk in China (17–20). A case-control study in nearby Hangzhou, China, suggested that consumption of dietary fat, particularly saturated fat from animal foods, and prolonged sitting time were associated with risk of colon cancer (17). In a record linkage study in Shanghai, an excess risk for colon cancer was observed among those who had jobs with low levels compared with those with high levels of physical activity (20). In addition, several studies based on migrant populations have suggested an increase in colorectal cancer risk among Chinese who migrated to the United States (17) and Australia (21). Thus, an emerging Western lifestyle in Shanghai, including high intake of fat and meat and reduced levels of physical activity, may, in part, explain the rising incidence of colon cancer. In contrast, the lack of change in incidence of rectal cancer might be due to weaker associations with such lifestyle factors. For example, in two case-control studies among Asians that separately examined cancers of the colon and rectum, no association was found with animal foods and total fat intake for rectal cancer (22, 23). In addition, a protective effect of physical activity was associated only with risk for colon cancer and not with risk for rectal cancer in two other studies conducted among Asian populations (17, 24).

The variation in incidence rates for subsites by age and sex in our study is consistent with those shown in previous studies in the United States. Among United States whites, the male:female rate ratios increased from the proximal colon to the distal colon and rectum (5). Sex-specific rates of distal colon cancer by age in our study also resembled findings in the Western countries, with women having higher rates than men prior to an age of 55 years and reversed sex ratios at older ages (16). For proximal cancer, however, the rates were almost identical for both sexes except for the oldest age groups, which were based on a small number of cases in our study. On the other hand, these patterns are in contrast with those seen in Japan, where mortality rates for distal colon cancer have shown a large increment and those for proximal colon cancer have been stable in both sexes. In Japan, the rising distal colon cancer rate has surpassed that for proximal colon cancer among men since the mid-1970s (25).

Reasons for variations in subsite incidence rates of colorectal cancers by age and sex are unclear. Although it has been proposed that risks of distal colon and rectal cancers are more likely to be related to environmental factors (25, 26), whereas host factors, such as genetic susceptibility, hormonal, and other endogenous factors, are linked more strongly to proximal colon cancer (27), not all analytical studies support this. Limited studies have examined risk factors by subsite, but findings are largely inconsistent. For example, dietary factors have been more likely related to risk of large bowel cancers among those of ages ≥40 years,

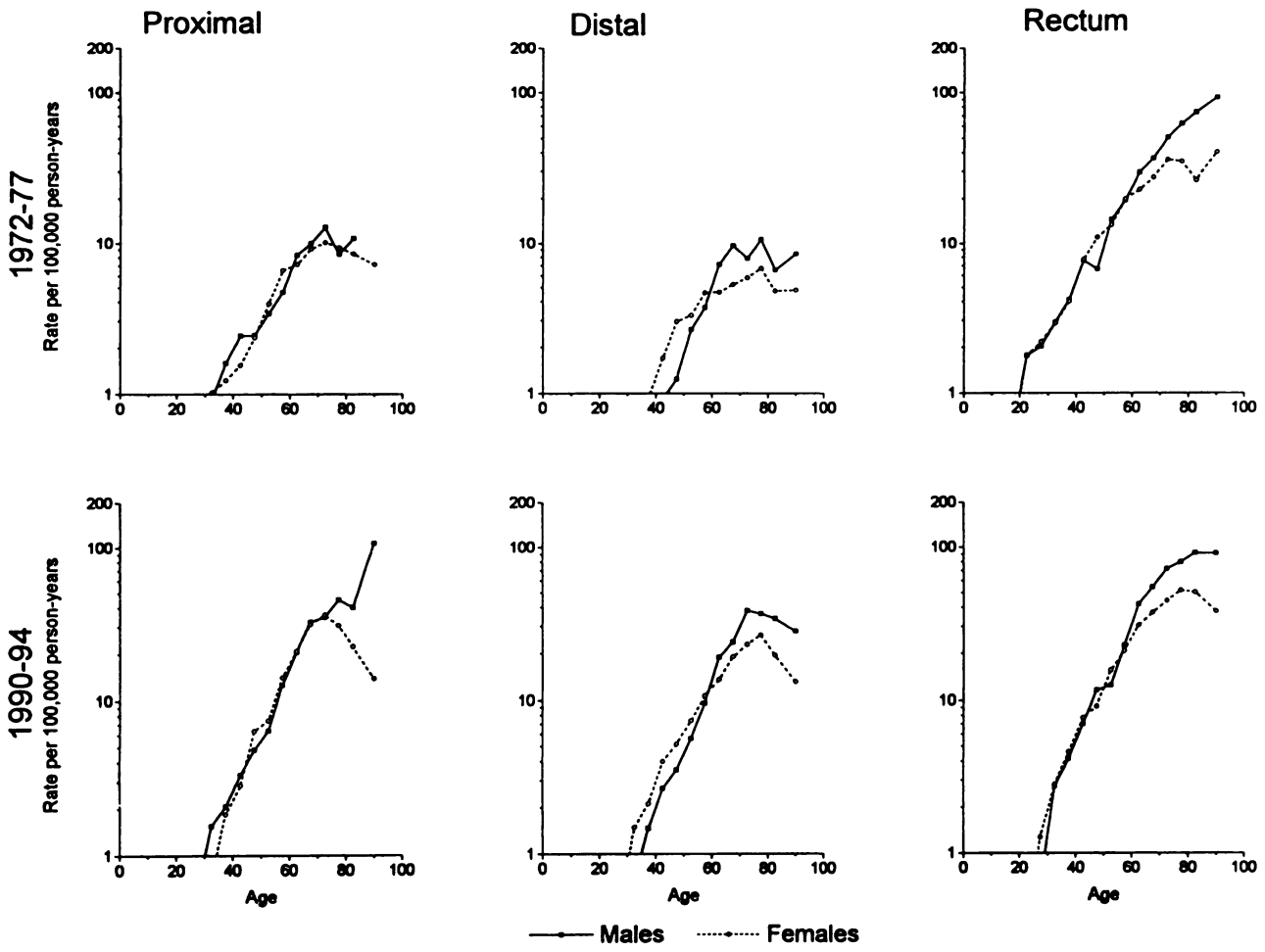

Fig. 3. Age-specific rates for colorectal cancer in Shanghai by site and sex, 1972–1977 and 1990–1994. Note that no cases of proximal cancer were diagnosed among males ages ≥85 years during 1972–1977.

whereas genetic factors tended to be more important in the younger ages (19). Alcohol consumption appeared to influence rectal cancer more strongly than colon cancer (9). Habitual smoking increased the risk of rectal cancer but not for colon cancer, and intake of traditional Japanese-style foods decreased the risk for distal colon cancer in Japan (28). In Japan, a "right-to-left shift" in colon cancer incidence occurred, thought to be related to Westernization of lifestyle (25, 26); this shift in colon cancer incidence by subsite was not evident in Shanghai. Further observations are needed to explore whether there are different risk patterns between these two countries.

In conclusion, in Shanghai, China, colorectal and, especially, colon cancer incidence rates have increased dramatically over time. The variation in subsite trends of colorectal cancer, together with the changes in environmental factors in Shanghai, may provide an opportunity to examine subsite-specific risk factors.

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