Epidemiology of Colorectal Cancer in Asia-Pacific Region

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Abstract

Colorectal cancer is the third most common cancer with about 1.36 million new cases and 694,000 deaths worldwide. Over the past two decades, colorectal cancer incidence has been drastically increasing in countries of the Asia-Pacific region, such as the Republic of Korea, Singapore, the Philippines, Thailand, and China. There is large geographic variation in colorectal cancer incidence and mortality throughout the world. The Republic of Korea has the highest colorectal cancer incidence (45 per 100,000). While the incidence of colorectal cancer has been stabilizing in parts of Northern and Western Europe and the USA, the rates have rapidly increased in economically developed Asia-Pacific countries such as Australia, New Zealand, Japan, Korea, and Singapore. The 5-year survival was estimated to be ranging from 28.1% to 66.0% for colon cancer patients and 39.7–65.9% for rectal cancer patients diagnosed during 2005–2009 in Asian countries.

A sharp increase in the incidence of colorectal cancer in Asian developed countries may be attributable to economic growth and environmental factors such as a Western lifestyle. Lifestyle-related risk factors of colorectal cancer include smoking, alcohol drinking in men, high consumption of red meat and processed meat, body fatness, abdominal fatness, and physical inactivity. Colorectal cancer has clearly become an emerging health threat in Asia-Pacific regions and is dramatically increasing in its incidence. Prevention and treatment programs for colorectal cancer control should be actively implemented and evaluated in this region.

Keywords

Colorectal cancer incidence · Epidemiology · Geographic variation · Risk factor · Lifestyle

1.1 Trends of Colorectal Cancer Incidence and Mortality

Colorectal cancer is the third most common cancer with about 1.36 million new cases and 694,000 deaths worldwide. Colorectal cancer ranks the third in cancer incidence of men (746,000 cases, 10.0% of the total cancer incident cases) and the second in women (614,000 cases, 9.2% of the total cancer incident cases) [1]. Approximately 55% of the newly diagnosed colorectal cancer cases occur in more developed regions. Colorectal cancer is the fourth leading cause of cancer deaths (8.5% of the total) in the

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world. Unlike incident cases, more colorectal cancer deaths occur in less developed regions of the world (52%) which implies a worse survival in these regions [1].

The Republic of Korea has the highest colorectal cancer incidence in the world according to the GLOBOCAN 2012 estimates, with an age-standardized incidence rate of 45.0 per 100,000 person-years, followed by Slovakia (42.7 per 100,000), Hungary (42.3 per 100,000), Denmark (40.5 per 100,000), and the Netherlands (40.2 per 100,000). Most of the countries listed in the top 20 highest colorectal cancer incidence rates are in Northern Europe, but it is notable that Asia-Pacific countries such as the Republic of Korea, Singapore, Japan, Australia, and New Zealand are also included (Table 1.1). The colorectal cancer incidence rate in the Republic of Korea is remarkably high compared with that of other Asian countries (13.7 per 100,000) and the USA (25.0 per 100,000). Despite its rapid increase of incidence rate (20.4 in 1999 and 36.2 in 2009, average percent change of 6.2%), the 5-year survival improved dramatically from 58.0% to 76.3% over the last two decades in Korea [2, 3]. Both early detection through nationwide cancer screening and advancement of cancer treatment may have contributed to the improved survival in colorectal cancer patients in the Republic of Korea. However, most recent statistics of Korea show that the colorectal cancer incidence began to decrease after year 2010 with annual percent change of −4.6% [3].

Table 1.1 Top 20 countries with highest colorectal cancer incidence rates in the world

Population	Number of incident cases	Crude incidence rates	Age-standardized incidence rates[a]
Republic of Korea	33,773	69.5	**45.0**
Slovakia	3963	72.3	**42.7**
Hungary	8442	84.8	**42.3**
Denmark	4832	86.4	**40.5**
The Netherlands	13,918	83.3	**40.2**
Czech Republic	8336	78.9	**38.9**
Norway	3913	78.9	**38.9**
Australia	15,869	69.2	**38.4**
New Zealand	3018	67.6	**37.3**
Slovenia	1621	79.5	**37.0**
Belgium	8683	80.5	**36.7**
Israel	4033	52.4	**35.9**
Canada	23,769	68.5	**35.2**
Ireland	2560	55.9	**34.9**
Italy	48,110	78.9	**33.9**
Singapore	2662	50.6	**33.7**
Spain	32,240	68.9	**33.1**
Croatia	3209	73.1	**32.9**
Serbia	5513	56.0	**32.6**
Japan	112,675	89.1	**32.2**

Data were generated from GLOBOCAN 2012 estimates [1]
[a]Age-standardized rates were based on the world population (per 100,000 person-years)

1.1.1 Temporal Trends

Over the past two decades, colorectal cancer incidence has been drastically increasing in countries of the Asia-Pacific region, such as Singapore, the Philippines, Thailand, the Republic of Korea, and China (Fig. 1.1). While colorectal cancer incidence of Japanese men appeared to decrease since 1993, most countries in Fig. 1.1 shows significantly increasing trend in Asia. Similarly increasing trends are observed in Western and Northern European countries such as Denmark, England, Finland, and Slovakia, while decreasing trend has been observed in the USA, Australia, and France [4].

1.1.2 Geographic Variations

While colorectal cancer affects men and women almost equally, there is large geographic variation in colorectal cancer incidence and mortality throughout the world [5]. Colorectal cancer is known to be common in developed countries and be associated with Western lifestyle [6]. There is a large variation in colorectal cancer incidence rates (Fig. 1.2). The age-standardized colorectal incidence rate in more developed regions is 29.2 per 100,000 in contrast to 11.7 per 100,000 in less developed regions, and there is 37-fold dif-

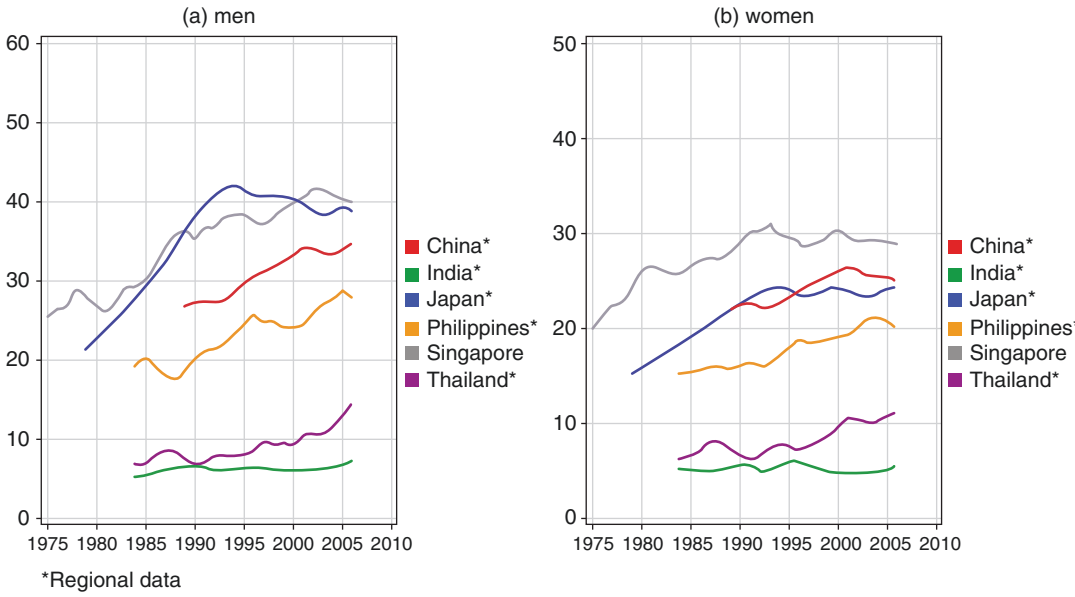

Fig. 1.1 Trend of colorectal cancer incidence in selected Asian countries. (**a**) Men. (**b**) Women. Source: GLOBOCAN 2012, http://globocan.iarc.fr/old/FactSheets/cancers/colorectal-new.asp

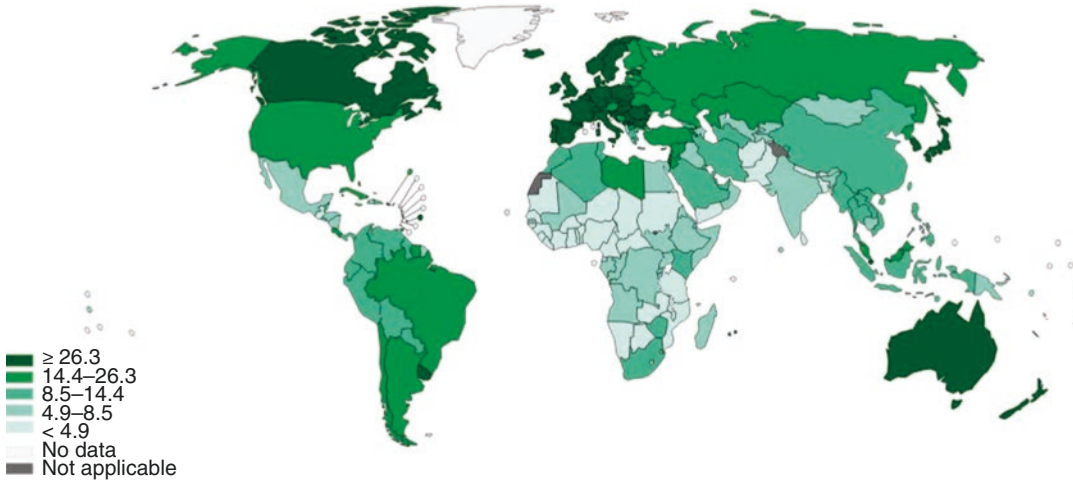

Fig. 1.2 Estimated colorectal cancer incidence rates in the world, age-standardized rates per 100,000 person-years. Source: GLOBOCAN 2012, http://globocan.iarc.fr

ference in the rate of the Republic of Korea (highest, 45.0 per 100,000) and Mozambique (lowest, 1.2 per 100,000) [4].

In contrast to a large discrepancy in colorectal cancer incidence across regions, there is less difference in colorectal cancer mortality. The age-standardized colorectal cancer mortality rate in more developed regions is 11.6 per 100,000 compared with 6.6 per 100,000 in less developed regions. Hungary has the highest colorectal cancer mortality (20.8 per 100,000) and Mozambique has the lowest (0.9 per 100,000) [4].

While the incidence of colorectal cancer has been stabilizing in parts of Northern and Western Europe and the USA, the rates have rapidly increased in economically developed Asia-Pacific countries including Australia, New Zealand, Japan, Korea, and Singapore.

Through investigating the trends of colorectal cancer by subsite, substantial variation in subsite distribution of colorectal cancer in Asian countries was observed, and it was suggested that increase in overall colorectal cancer incidence may be mainly due to the increase in colon cancer, but not rectal cancer [7].

1.1.3 Survival of Colorectal Cancer Patients

According to the recent global study (CONCORD-2), the 5-year survival in Asia was estimated ranging from 28.1% to 66.0% for colon cancer patients and 39.7–65.9% for rectal cancer patients diagnosed during 2005–2009 [8]. Table 1.2 summarizes the age-standardized incidence rates and 5-year survival for colorectal cancer in selected countries. In particular, 5-year survival estimates of the Republic of Korea and Japan appear to be similar to those of Australia and the USA.

It was also shown that the 5-year survival has risen for both colon and rectal cancers in most developed countries and regions, such as North America, Europe, and Oceania, and parts of East Asia including the Republic of Korea and urban region of China [8].

Table 1.2 Age-standardized incidence rates and 5-year survival for colorectal cancer in selected countries

Population	Age-standardized incidence rates (per 100,000)	5-year survival	
		Colon cancer	Rectal cancer
Republic of Korea	45.0	66.0	65.9
Japan	32.2	64.4	60.3
China	14.2	54.6	53.2
Malaysia	18.3	53.3	42.5
Indonesia	12.8	28.1	58.0
Thailand	12.4	50.4	39.7
Australia	38.4	64.2	64.2
New Zealand	37.3	61.6	60.8
USA	25.0	64.7	64.0
UK	30.2	53.8	56.6

Age-standardized rates of colorectal cancer are from GLOBOCAN 2012 [4], and 5-year survival estimates for cancer patients diagnosed in 2005–2009 are from CONCORD-2 [8]

1.2 Risk Factors

A sharp increase in the incidence of colorectal cancer in Asian developed countries may be attributable to economic growth and environmental factors such as a Western lifestyle. Lifestyle-related risk factors of colorectal cancer include smoking, alcohol drinking in men, high consumption of red meat and processed meat, body fatness, abdominal fatness, and physical inactivity. These factors were mostly classified as having a convincing evidence for their association with significantly increased risk of colorectal cancer after being evaluated by expert groups of the World Cancer Research Foundation (WCRF) and American Institute for Cancer Research [9]. The WCRF report showed that foods containing dietary fiber, garlic, nonstarchy vegetables, fruits, foods containing folate and selenium, soy products, and green tea may have a protective effect against colorectal cancer risk, but the level of evidence was weaker (Table 1.3).

An update of the WCRF report was recently published from a comprehensive search on foods and beverages and their association with colorectal cancer during the period of January 1, 2010, to May 31, 2015. This reevaluation confirmed that red and processed meat consumption and alcohol drinking are still significant risk factors for colorectal cancer [10]. There was insufficient evidence for the association with colorectal cancer risk for the consumption of fruits, legumes, poultry, coffee, and tea.

1.2.1 Smoking

While many studies have reported a 20–60% increase in risk of colorectal cancer associated with active smoking, neither the International

Table 1.3 List of factors associated with colorectal cancer

Level of evidence	Increase RISK	Decrease RISK	Evidence source
Convincing	Smoking	Physical activity (colon)	WCRF
	Alcohol drinking (men)		WCRF
	Red meat		WCRF
	Processed meat		WCRF
	Body fatness		WCRF
	Abdominal fatness		WCRF
Probable	Alcohol drinking (women)	Foods containing dietary fiber	WCRF
		Garlic	WCRF
		Non-starchy vegetables	
		Fruits	WCRF
		Foods containing folate	
		Selenium	
		Soy products	
		Green tea	
		Milk	WCRF-update
		Whole grain	
		Fish	
Less convincing		Vegetables	WCRF-update
Not associated	Coffee	Fruits	WCRF-update
	Tea		

WCRF World Cancer Research Fund [9]; WCRF-update [10]

Agency for Research on Cancer nor the US Surgeon General has classified smoking as a convincing risk factor for colorectal cancer because of concern about residual confounding [11]. A large prospective cohort study of over 180,000 subjects showed that the incidence of colorectal cancer was significantly higher among current smokers (hazard ratios (HR) = 1.27, 95% CI: 1.06–1.52) and among former smokers (HR = 1.23, 95% CI: 1.11–1.36) compared with nonsmokers, even in the analysis after controlling for 13 potential confounding factors including screening [11]. Studies in Korea and Japan also showed elevated risk of colorectal cancer among smokers compared to nonsmokers [12, 13].

1.2.2 Alcohol Drinking

Alcohol drinking is a known risk factor for colorectal cancer with convincing evidence. There was a significant dose-response relationship (RR = 1.07, 95% CI: 1.05–1.09, per 10 g/day increment) [10]. In a pooled analysis of Korean data, there was an elevated risk of colorectal cancer (RR = 1.12 in men and RR = 1.19 in women for average alcohol consumption of 28.53 g/day in men and 6.38 g/day in women, respectively). Even light drinking (≤1 drink/day) was shown to be associated with the increased incidence of male colorectal cancer in a meta-analysis [14].

1.2.3 Meat Consumption

High consumption of red meat and processed meat possibly increases risk of colorectal cancer or colon cancer in both Japanese and Korean populations [15, 16]. An updated WCRF report reinforced the evidence that high intake of red and processed meat and alcohol increases the risk of colorectal cancer [10]. In particular, red and processed meat consumption showed a significant dose-response relationship with colorectal cancer risk (RR = 1.12, 95% CI: 1.04–1.21, per 100 g/day increment).

However, dietary fat and its association with colorectal cancer may be still controversial. A meta-analysis of 13 prospective cohort studies showed that dietary fat may not be associated with increased risk of colorectal cancer [17].

1.2.4 Obesity and Physical Inactivity

Obesity and physical inactivity were found to increase the colorectal cancer risk. Both body fatness and abdominal fatness were shown to have convincing evidence to increase the colorectal cancer.

According to the WCRF evaluation, most of the cohort studies out of 60 studies showed that body fatness increased the risk of colorectal cancer. Meta-analysis showed that summary effect estimate of 1.03 (85% CI: 1.02–1.04) per 1 kg/m^2 increment of body mass index [9]. Abundant and consistent epidemiological evidence exists that greater body fatness is a cause of colorectal cancer.

1.2.5 Fruits and Vegetables

Based on the update of WCRF report, vegetables (RR = 0.98, 95% CI: 0.96–0.99, 100 g/day increment) were inversely associated with the risk of colorectal cancer [10]. However, there does not seem to be sufficient evidence for the protective effect of fruits on colorectal cancer. The studies conducted in Japanese and Korean population showed inconsistent results. A recent study on Japanese population showed that there was insufficient evidence to support an association between vegetable intake and colorectal cancer risk [18]. Furthermore, a meta-analysis on Korean population showed that vegetables and soybeans were not significantly associated with colorectal cancer risk [16].

1.2.6 Soy Product and Green Tea Consumption

Soy intake and green tea consumption represent a protective Asian diet that has drawn much attention recently. Soy product consumption was inversely associated with the incidence of overall GI cancer (0.857; 95% CI: 0.766, 0.959) and the gastric cancer subgroup (0.847; 95% CI: 0.722, 0.994) but not the colorectal cancer subgroup [19]. Green tea consumption is not associated with colorectal cancer prevention [20]. Furthermore, with an increment of 1 cup/day of green tea consumption, there was a protective effect on colorectal cancer risk (OR = 0.98, 95% CI = 0.96–1.01, in men; OR = 0.68, 95% CI = 0.56–0.81, in women) [21].

Regarding coffee consumption, compared to non-drinkers, ORs of less than 1 cup/day, 1–2 cups/day, and 3 or more cups/day for colorectal cancer were 0.88 (95% CI: 0.77–1.00), 0.90 (95% CI: 0.80–1.01), and 0.78 (95% CI: 0.65–0.92), respectively (p for trend = 0.009) [22].

1.2.7 Dairy Product and Whole Grains

Milk and whole grains may have a protective role against colorectal cancer. High consumption of dairy product (RR = 0.87, 95% CI: 0.83 = 0.90, per 400 g/day increment) and total milk (RR = 0.94, 95% CI: 0.92–0.96, per 200 g/day increment) were associated with lowering colorectal cancer risk [10].

1.2.8 Migrant Studies

Migrant studies implied that patterns of cancer among migrant groups often change faster than they do among people that remain in their home country. For instance, one migrant study revealed that colorectal cancer incidence in US-born Japanese men and women had 40–50% higher colorectal incidence rates than foreign-born Japanese men and women [23]. Such findings may suggest that changing into a Western lifestyle increases the risk of colorectal cancer.

Table 1.4 summarizes the PAF estimates of each risk factor for colorectal cancer incidence in Korea, Japan, and China. When comparing these three countries, PAF estimates for smoking and alcohol drinking seem to be quite high in Japanese population. According to the estimated population attributable fraction (PAF) in Korea, approximately 17% of colorectal cancer incidence was attributable to risk factors including smoking, alcohol drinking, overweight and obesity, and physical inactivity [24].

Colorectal cancer has clearly become an emerging health threat in the Asia-Pacific region and is dramatically increasing in its incidence. Prevention and treatment programs for colorectal cancer control should be actively implemented and evaluated in this region.

Table 1.4 Population attributable fraction (%) of lifestyle-related factors for colorectal cancer in Korea, Japan, and China

	Republic of Korea		Japan		China	
Population	Men	Women	Men	Women	Men	Women
Smoking	1.50	0.02	20.4	4.5	–	–
Alcohol drinking	8.57	4.23	32.9	2.1	2.06	0.15
Excess body weight	6.75	6.60	5.2	4.0	1.39[a] (0.65)	NA[a] (1.80)
Physical inactivity	0.78	0.87	3.2	3.9	–	–

PAF estimates for Korea [12, 24–26]; Japan [13]; China [27, 28]
[a]Colon (Rectum)

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