Prostate cancer is one of the most common cancers in males, particularly at elderly ages. The worldwide incidence of prostate cancer has been increasing, although it is debatable whether this reflects a true increase in cases or is an artifact of the use of more sensitive detection methods such as prostatic transurethral resection and testing for prostate-specific antigen (PSA)[1]. Ninety percent of deaths due to prostate cancer occur after age 65, at a median age of 77 years[2]. Survival following prostate cancer is relatively favorable; five-year relative survival is about 93%[3].

Risk Factors

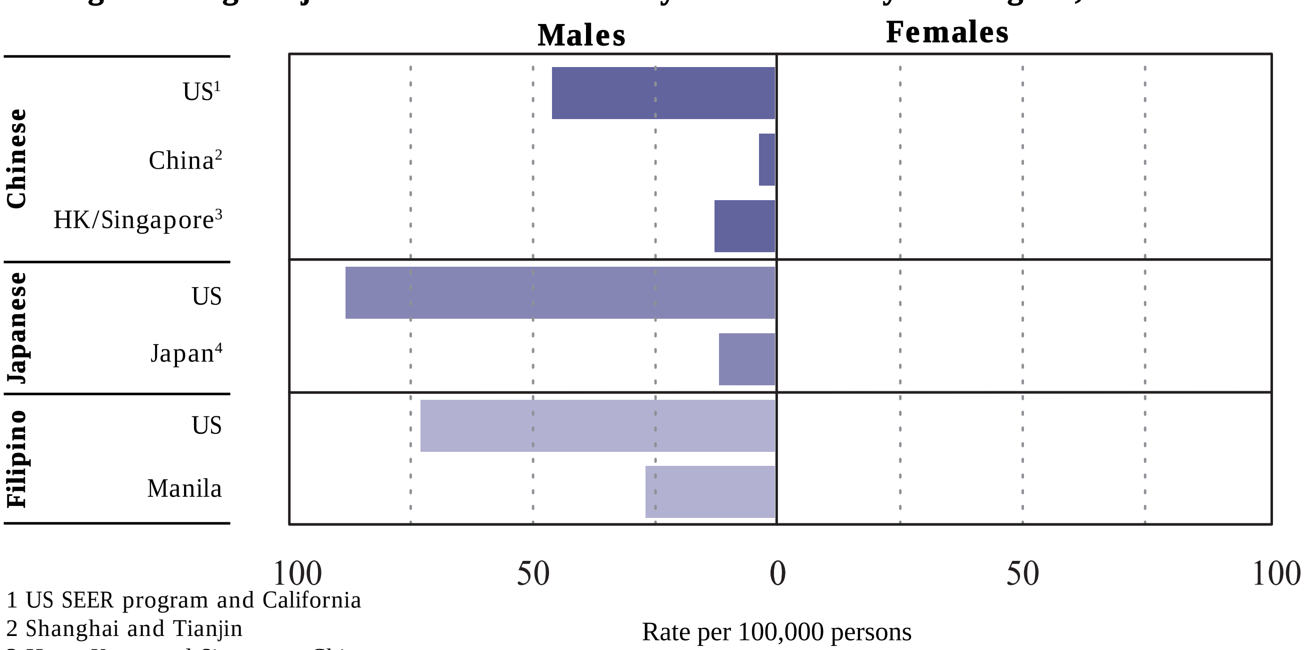
Though the causes of prostate cancer are unknown, hormonal, familial, and dietary factors have been shown to be associated with an increased risk of the disease. The risk factor that most closely correlates with prostate cancer is advancing age. After age 40, incidence rates increase exponentially, faster than for any other cancer[1,2].

The functions of the prostate are largely controlled by testosterone, which is converted into dihydrotestosterone (DHT) by the enzyme 5-alpha reductase[2]. These steroid hormones may play a significant role in the development of prostate cancer. It has been noted that despite having similar levels of serum testosterone, Japanese and Chinese males in Asia have reduced expression and activity of 5-alpha reductase, and thus lower levels of DHT, than whites in the United States[4,5]. The substantially lower incidence rates of prostate cancer in Asian populations compared to whites suggest that the conversion of testosterone to DHT may be a necessary promotor in prostate carcinogenesis. This variability in 5-alpha reductase expression and activity between Asian and white males has stimulated interest in 5-alpha reductase inhibitors as potential prostate cancer drugs[2].

The results from studies exploring the role of dietary factors in the risk for prostate cancer have been largely inconsistent, with the exception of dietary fat. Intake of dietary fat, particularly saturated fat, is now generally accepted to be a consistent risk factor for the development of prostate cancer[6-13]. While several studies have detected no association with nutrients contained in fruits and vegetables[9,14], others have shown a reduced risk of prostate cancer with the increased consumption of beta-carotene and yellow and green vegetables[15,16]. Other risk factors studied among Asian populations include physical inactivity[10,17-19], alcohol use and cigarette smoking[2], increased height, weight, and body mass index[10,13,14,20], and vasectomy[21-23]; however, evidence that these risk factors increase prostate cancer risk has been inconclusive.

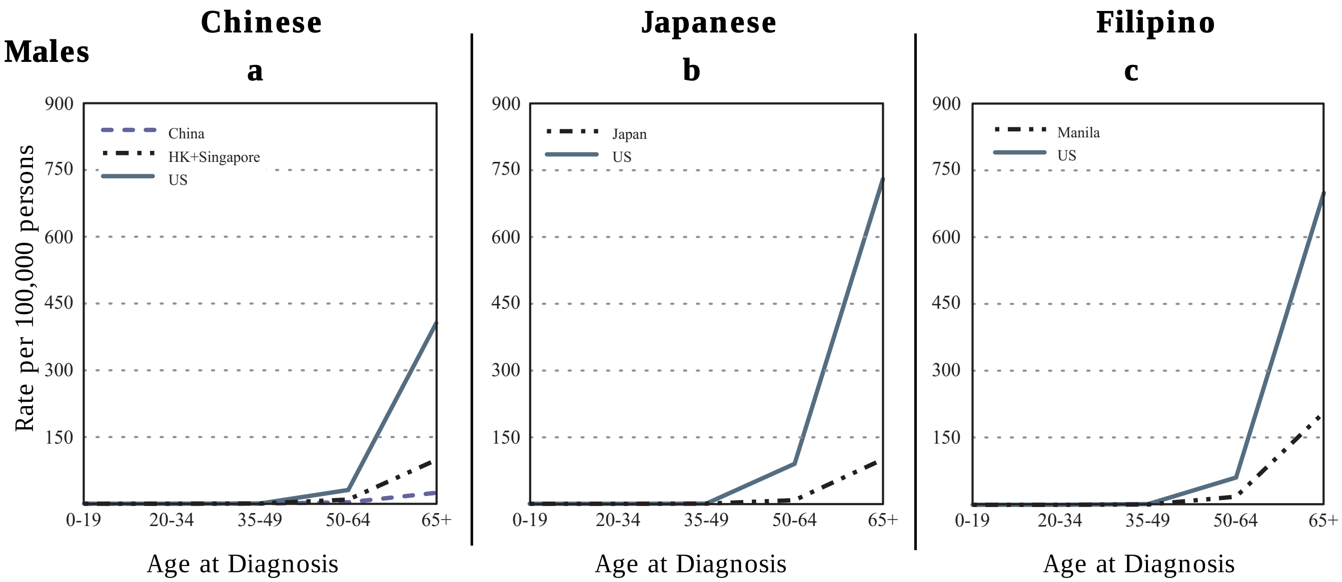
Various studies suggest that a history of benign prostatic diseases is significantly associated with prostate cancer[2], increasing risk up to 13-fold according to a study in Japan[15]. Epidemiologic data also support the

Figure 1: Age-adjusted incidence rates by race/ethnicity and region, 1988-1992



1 US SEER program and California
2 Shanghai and Tianjin
3 Hong Kong and Singapore-Chinese
4 Miyagi, Nagasaki, Osaka, Yamagata, Saga

Figure 2: Age-specific incidence rates by race/ethnicity and region, 1988-1992



positive association between a family history of prostate cancer, particularly in first-degree relatives (father, son and/or brother), and risk of the disease[2,24].

Incidence

Incidence rates of prostate cancer differ greatly by race/ethnicity and place of residence. Native Chinese, Japanese, and Filipino males had some of the lowest incidence rates in the world, but incidence rates among Asians in the US show a three- to five-fold excess risk over native Asians (Figure 1). In US Asian groups, prostate cancer ranked as the first or second most commonly diagnosed malignant disease.

Age-specific rates show that the geographic differences in incidence occurred mainly in those 65 and older (Figures 2a-2c). For example, among males in China, the increase in incidence with age was fairly linear, but among US Chinese, the incidence increase was exponential with age. In US Chinese, the incidence rate for men over age 65 was more than 13 times greater than the rate among men aged 50-64; in native Chinese, the rate among those aged 65+ was only eight times greater than the rate for the 50-64 age group (Figure 2a). Although some differences in early detection may exist between countries, these dramatic differences in incidence rates between native and host countries indicate that environmental, and thus potentially modifiable, risk factors may play a role in the development of this very common cancer[2].

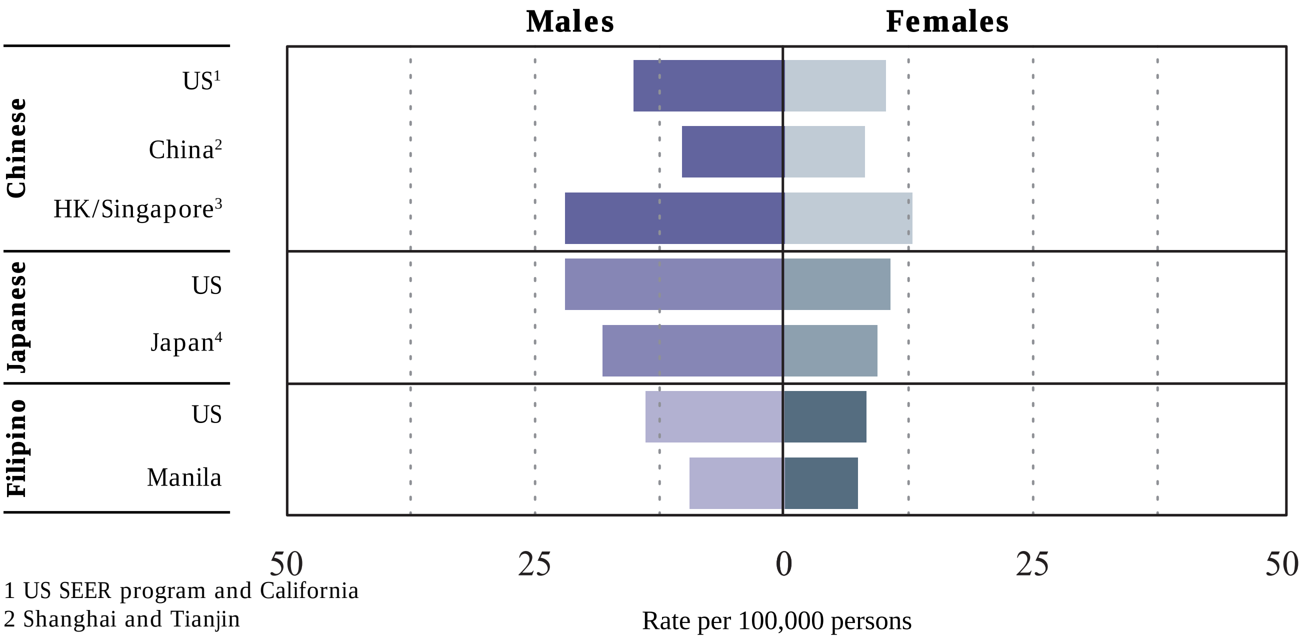
In the large intestine, which consists of the colon and the rectum, the rectum comprises the last five or six inches above the anus. Cancer of the rectum is often grouped with cancer of the colon due to the anatomical and physiological similarities of these sites; however, because rectal cancer incidence makes up about 30% of all cases diagnosed as colorectal cancer in the United States, it is useful to consider it separately. Rectal cancer is more common among males than females, with an age-adjusted male-to-female incidence rate ratio of 1.5 to 2.0[1]. In Japan, the incidence rate of rectal cancer has been increasing, but the five-year survival rates have gradually improved. The relative five-year survival rate for colorectal cancer in Japan exceeds 60%[2].

Risk Factors

The occurrence of cancer of the rectum is influenced by dietary and lifestyle characteristics. Rectal cancer shares some risk factors with colon cancer, including: alcohol consumption; cigarette smoking; high total energy intake (regardless of caloric source); high consumption of dietary fats and red meats; and low intake of vegetables, fruits, grains, and fiber[1,3-6]. For example, in China, a decreased risk of rectal cancer was associated with an increased intake of vegetables and grains, and decreased alcohol consumption[7]. In Singapore, diets which included a high intake of protein, fiber, and beta-carotene provided a protective effect against rectal cancer[4]. Risk factors distinct from those associated with colon cancer include intake of a high percentage of calories from carbohydrates, and high consumption of eggs and dairy products[5]. Rates of rectal cancer among Asians in the US have increased, most likely due to the adaptation of a Western diet and lifestyle, which is characterized by many of the dietary risk factors listed above.

Although sedentary occupations and lifestyles increased the risk of rectal cancer in Chinese from both the US and China[3], limited physical activity does not appear to be as strong of a risk factor for rectal cancer as it is for colon cancer, since studies have found inconsistent results regarding its association[6,8]. Similarly, the role of genetic mutations in the risk of rectal cancer is not clear. However, research on colorectal cancer as a whole indicates that mutations on several genes (p53, adenomatous polyposis coli (APC) gene, Ki-ras oncogene) may play a part in rectal cancer disease progression[9,10].

Figure 1: Age-adjusted incidence rates by sex, race/ethnicity, and region, 1988-1992

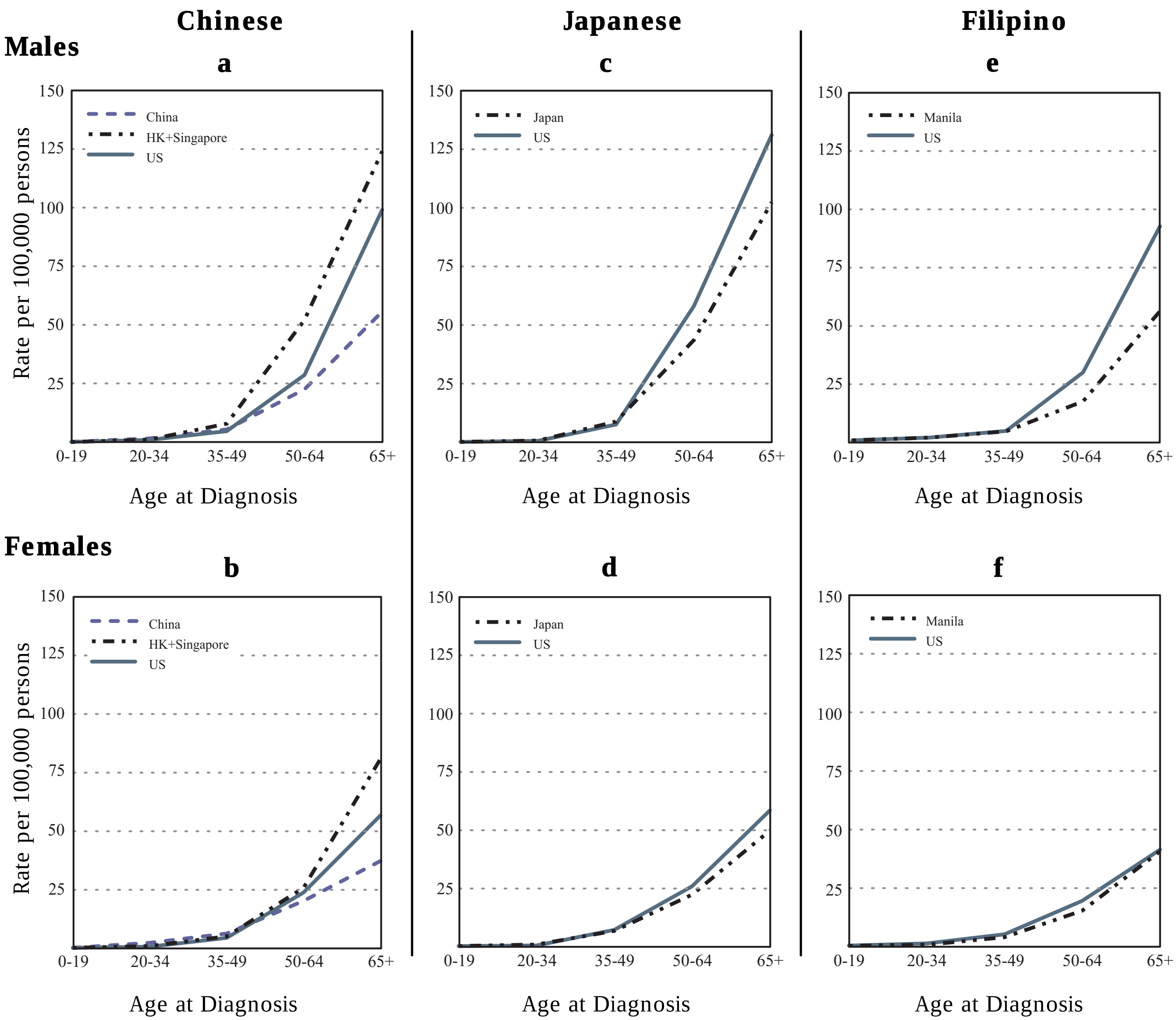


1 US SEER program and California
2 Shanghai and Tianjin
3 Hong Kong and Singapore-Chinese
4 Miyagi, Nagasaki, Osaka, Yamagata, Saga

Incidence

Among Chinese, incidence rates of rectal cancer were lower in the US than in Singapore, but higher than in China (Figure 1)(Note: Data from Hong Kong, Yamagata and Saga registries were not included in the calculation of rectal cancer incidence rates, because of grouping of rectal and anal cancer cases in these registries). Both Japanese and Filipinos experienced higher incidence rates of rectal cancer in the US than in Asia. Filipinos in Manila had the lowest incidence rates of

Figure 2: Age-specific incidence rates by race/ethnicity, sex, and region, 1988-1992



rectal cancer of any of the three Asian populations. These geographic differences in rates are probably due, in part, to the different dietary patterns in each location.

The incidence rate of rectal cancer among Chinese males in the US dramatically increased with age--about 2.5-fold from ages 50-64 to ages 65 and older (Figure 2a). Chinese females in Singapore aged 65 and older had incidence rates of rectal cancer two times greater than similarly-aged Chinese females in China (Figure 2b). In contrast, among Japanese and Filipino females over age 65, rectal cancer rates were quite comparable for US and Asian populations (Figure 2d, 2f).

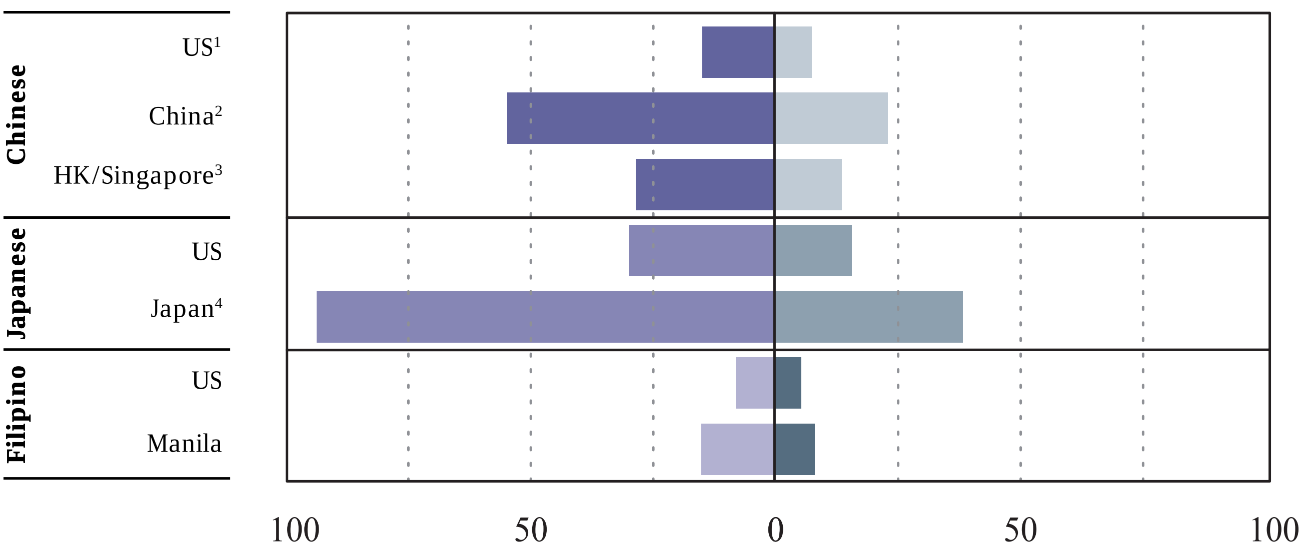
Worldwide, stomach cancer is the second leading cause of cancer death[1]. In Japan, it has been the leading cause of cancer death since 1981[2], while in China, it is the second leading cause of death overall, despite declining rates in the past two decades[3]. Although the incidence and mortality rates of stomach cancer have decreased dramatically in the last 50 years, this disease remains the seventh most common cause of cancer death in United States males, and the sixth in US females[4]. Survival from stomach cancer has improved in the US in the past few decades, but the five-year survival rate remains among the poorest of any cancer[5].

Risk Factors

Stomach cancer occurs among older persons, with rates beginning to increase after age 40[6]. Males generally have incidence rates twice as high as females. Diet is believed to be a major risk factor in stomach cancer development; in China and Japan, epidemiologic studies have shown that stomach cancer rates were higher among those who consumed less vitamin A and beta carotene, and more sodium[7,8] and carbohydrates[2]. Numerous studies have shown that consumption of N-nitroso compounds increases stomach cancer risk[9,10]. These compounds form in the digestive tract after ingestion of foods containing nitrates and are contained as pre-formed nitrosamines in many salted, cured, and process foods. Obesity has been found to contribute to increased stomach cancer risk in China, as well as in Western countries[11]. Dietary modifications, such as smaller portion size and decreased intake of spicy and salty foods, were found to lower risk of stomach cancer development in a large Japanese study[12].

Infection with the gastric bacterium *Helicobacter pylori* has been shown to play a role in increasing stomach cancer risk, particularly in combination with poor practices in food refrigeration and handling, and with a diet low in fruits and vegetables and high in sodium[1,13]. Current research is exploring the effect of *H. pylori* eradication on epidemiologic patterns in stomach cancer incidence rates[1]. Studies in China[14] and the US[15] found that cigarette smoking and alcohol consumption increased the risk of stomach cancer occurrence. A study of occupational exposures among iron and steel workers in China showed that long-term benzo(a)pyrene exposure was associated with stomach cancer development[16]. Other occupational exposures found to increase risk of the disease were silica, leaded gasoline, grain dust, hydraulic fluids, and ethers[17].

Figure 1: Age-adjusted incidence rates by sex, race/ethnicity, and region, 1988-1992

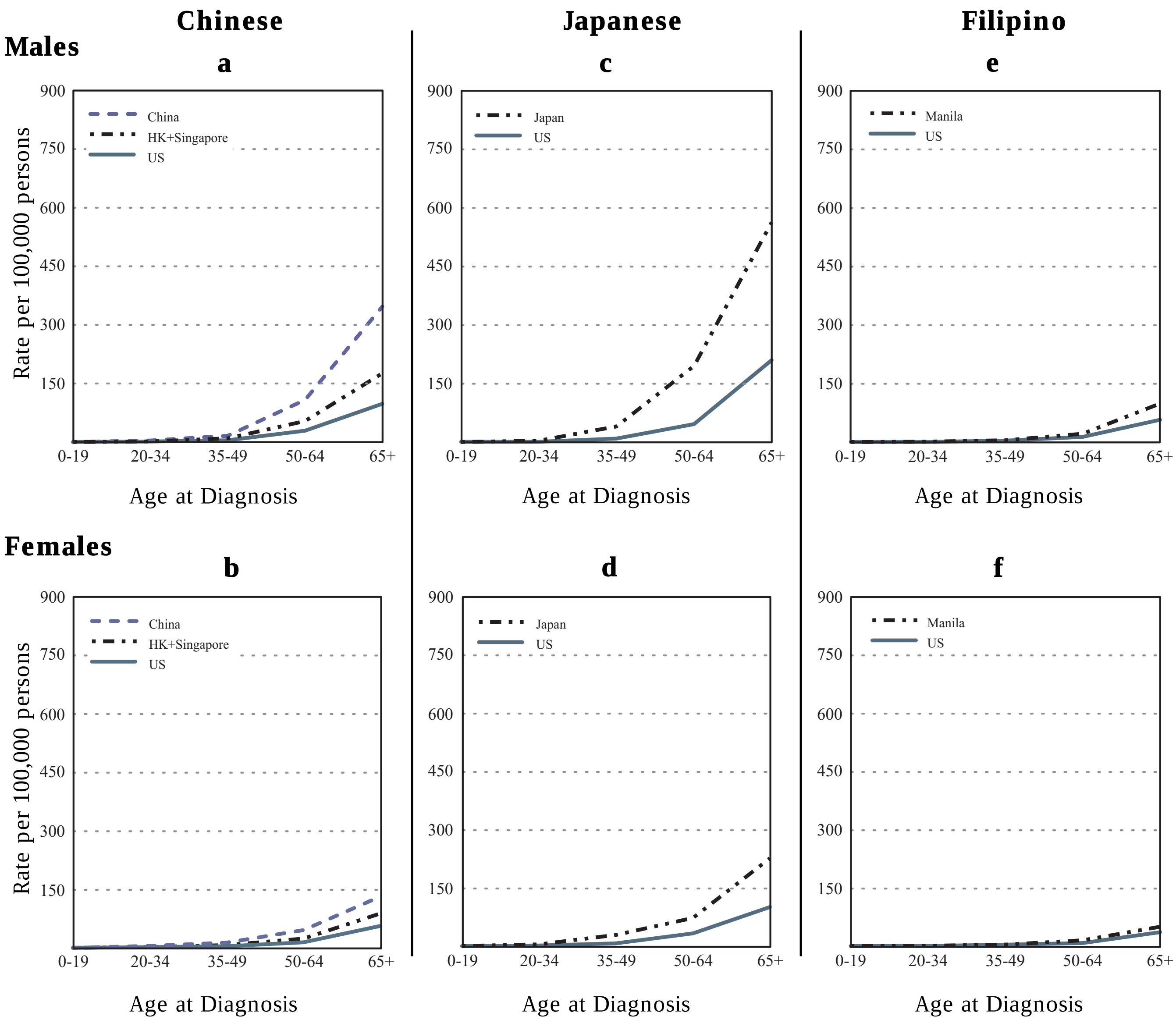


1 US SEER program and California
2 Shanghai and Tianjin
3 Hong Kong and Singapore-Chinese
4 Miyagi, Nagasaki, Osaka, Yamagata, Saga

Incidence

The age-adjusted incidence rates of stomach cancer during the period 1988-1992 were higher among males than females (Figure 1). Among Asian groups, the highest annual incidence rates for stomach cancer occurred in Japanese males (93 cases per 100,000 males). The rates for Asians living in the US tend to be consider-

Figure 2: Age-specific incidence rates by race/ethnicity, sex, and region, 1988-1992



ably lower than for Asians living in Asia; for example, the stomach cancer incidence rates for Chinese and Japanese in the US were about one-third the rates for persons in China and Japan. However, there was less difference in incidence rates between Filipinos in the US and those in Manila.

Age-specific rates for males and females began increasing after age 35 (Figures 2a-f). However, rates for males increased more dramatically with age (Figures 2a, 2c, 2e). Age-related increases in incidence rates were also more striking among Asians in Asia than in the US. The largest geographic difference in incidence occurred in Japanese males aged 65 years or older, with incidence rates 82% higher in Japanese in Japan than in the US (Figure 2c). The higher rates of stomach cancer observed in Japanese males may be due to dietary differences between this group and other Asian groups, both in Asia and the US.

Five-Year Counts, Average Annual Age-Adjusted Incidence Rates and 95% Confidence Intervals by Registry Group, 1988-1992[1]					
Registry Group	Count	US Standard		World Standard	
		Rate	95% CI	Rate	95% CI
MALES					
Chinese					
US[2]	827	45.8	42.4-49.3	31.3	29.0-33.6
China[3]	707	3.2	3.0-3.5	2.2	2.0-2.3
HK[4]/Singapore	1591	12.4	11.8-13.0	8.2	7.8-8.6
Japanese					
US	1748	88.3	83.6-93.0	60.1	57.0-63.2
Japan[5]	3877	11.5	11.1-11.9	7.5	7.3-7.8
Filipino					
US	1525	72.9	69.0-76.9	49.5	46.7-52.3
Manila	632	26.6	24.4-28.9	17.6	16.2-19.0

1 Data are not shown for rates based on fewer than 5 cases.
2 US = SEER + California
3 China = Shanghai + Tianjin
4 HK = Hong Kong + Singapore Chinese
5 Japan = Miyaki, Osaka, Saga, Yamagata, Nagasaki

Five-Year Counts, Average Annual Age-Specific Incidence Rates and 95% Confidence Intervals by Registry Group and Age, 1988-1992[1]

Age Group	MALES		
	Count	Rate	95% CI
US[2]-Chinese			
0-19	<5	-	-
20-34	<5	-	-
35-49	<5	-	-
50-64	80	30.9	24.5-38.4
65+	745	405.5	376.9-435.7
China[3]			
0-19	<5	-	-
20-34	6	0.1	0.0-0.2
35-49	12	0.2	0.1-0.3
50-64	134	3.2	2.7-3.7
65+	555	24.5	22.5-26.6
Hong Kong/Singapore Chinese			
0-19	<5	-	-
20-34	<5	-	-
35-49	17	0.4	0.2-0.6
50-64	239	9.2	8.1-10.5
65+	1333	98.3	93.1-103.7
US-Japanese			
0-19	<5	-	-
20-34	<5	-	-
35-49	<5	-	-
50-64	203	89.8	77.9-103.0
65+	1544	729.8	693.9-767.1
Japan[4]			
0-19	<5	-	-
20-34	<5	-	-
35-49	23	0.3	0.2-0.4
50-64	533	8.1	7.4-8.8
65+	3317	99.9	96.5-103.3
US-Filipino			
0-19	<5	-	-
20-34	<5	-	-
35-49	8	1.6	0.7-3.2
50-64	148	61.1	51.7-71.8
65+	1369	697.9	661.4-735.9
Manila			
0-19	<5	-	-
20-34	<5	-	-
35-49	11	0.7	0.3-1.2
50-64	132	18.2	15.2-21.6
65+	486	206.6	188.7-225.8

1 Data are not shown for rates based on fewer than 5 cases.
2 US = SEER + California
3 China = Shanghai + Tianjin
4 Japan = Miyaki, Osaka, Saga, Yamagata, Nagasaki

Five-Year Counts, Average Annual Age-Adjusted Incidence Rates and 95% Confidence Intervals by Registry Group and Sex, 1988-1992[1]

Registry Group	Count	US Standard		World Standard	
		Rate	95% CI	Rate	95% CI
TOTAL					
Chinese					
US[2]	496	12.5	11.3-13.7	9.6	8.7-10.5
China[3]	5107	9.0	8.7-9.2	7.3	7.1-7.5
Singapore	1301	17.0	16.0-17.9	13.4	12.6-14.1
Japanese					
US	699	15.6	14.4-16.9	12.4	11.4-13.4
Japan[4]	9628	13.2	12.9-13.4	10.5	10.3-10.8
Filipino					
US	460	11.0	10.0-12.1	8.6	7.8-9.4
Manila	695	8.3	7.6-9.0	6.5	6.0-7.0
MALES					
Chinese					
US	283	15.2	13.4-17.1	11.6	10.3-13.1
China	2680	10.3	9.9-10.7	8.1	7.8-8.4
Singapore	758	22.1	20.5-23.7	17.4	16.2-18.7
Japanese					
US	435	22.1	19.9-24.4	17.4	15.7-19.2
Japan	5822	18.3	17.8-18.8	14.5	14.1-14.8
Filipino					
US	279	14.0	12.3-15.8	10.8	9.5-12.3
Manila	360	9.6	8.5-10.8	7.4	6.6-8.3
FEMALES					
Chinese					
US	213	10.1	8.7-11.6	7.8	6.8-8.9
China	2427	8.0	7.7-8.3	6.6	6.4-6.9
Singapore	543	12.8	11.7-13.9	10.0	9.1-10.8
Japanese					
US	264	10.6	9.2-12.0	8.5	7.4-9.6
Japan	3806	9.3	9.0-9.6	7.5	7.2-7.7
Filipino					
US	181	8.2	6.9-9.5	6.6	5.6-7.6
Manila	335	7.3	6.4-8.1	5.7	5.1-6.4

1 Data are not shown for rates based on fewer than 5 cases.
2 US = SEER + California
3 China = Shanghai + Tianjin
4 Japan = Miyaki, Osaka, Nagasaki

Five-Year Counts, Average Annual Age-Specific Incidence Rates and 95% Confidence Intervals by Registry Group, Age, and Sex, 1988-1992[1]

Age Group	MALES Count	MALES Rate	MALES 95% CI	FEMALES Count	FEMALES Rate	FEMALES 95% CI
US[2]-Chinese						
0-19	<5	-	-	<5	-	-
20-34	5	0.9	0.3-2.0	<5	-	-
35-49	22	4.6	2.9-7.0	22	4.3	2.7-6.5
50-64	74	28.6	22.4-35.9	65	23.6	18.3-30.1
65+	182	99.1	85.2-114.6	123	56.5	47.0-67.4
China[3]						
0-19	<5	-	-	<5	-	-
20-34	123	1.5	1.2-1.8	160	2.2	1.8-2.5
35-49	342	5.3	4.8-5.9	354	6.1	5.5-6.8
50-64	952	22.5	21.1-24.0	892	20.1	18.8-21.4
65+	1261	55.6	52.6-58.8	1021	37.1	34.8-39.4
Singapore Chinese						
0-19	<5	-	-	<5	-	-
20-34	16	1.0	0.6-1.7	12	0.8	0.4-1.4
35-49	95	7.8	6.3-9.5	58	4.9	3.7-6.4
50-64	300	52.0	46.3-58.3	155	25.6	21.8-30.0
65+	347	124.0	111.3-137.8	318	80.6	72.0-90.0
US-Japanese						
0-19	<5	-	-	<5	-	-
20-34	<5	-	-	<5	-	-
35-49	25	7.4	4.8-11.0	25	7.0	4.5-10.3
50-64	131	57.9	48.4-68.8	87	25.6	20.5-31.6
65+	277	130.9	116.0-147.3	151	58.1	49.2-68.2
Japan[4]						
0-19	5	0.1	0.0-0.1	<5	-	-
20-34	39	0.6	0.4-0.8	44	0.7	0.5-0.9
35-49	639	8.7	8.1-9.4	483	6.5	5.9-7.1
50-64	2426	43.5	41.8-45.2	1279	22.0	20.9-23.3
65+	2713	102.3	98.5-106.2	2000	49.5	47.3-51.7
US-Filipino						
0-19	<5	-	-	<5	-	-
20-34	7	1.2	0.5-2.4	7	1.1	0.4-2.2
35-49	20	4.1	2.5-6.3	30	5.0	3.3-7.1
50-64	71	29.3	22.9-37.0	60	19.2	14.7-24.8
65+	181	92.3	79.3-106.7	83	41.1	32.7-50.9
Manila						
0-19	<5	-	-	<5	-	-
20-34	38	1.2	0.8-1.6	18	0.5	0.3-0.8
35-49	66	3.9	3.0-5.0	63	3.7	2.9-4.8
50-64	122	16.8	14.0-20.1	121	15.0	12.5-18.0
65+	131	55.7	46.6-66.1	130	40.3	33.7-47.9

1 Data are not shown for rates based on fewer than 5 cases.
2 US = SEER + California
3 China = Shanghai + Tianjin
4 Japan = Miyaki, Osaka, Nagasaki

Five-Year Counts, Average Annual Age-Adjusted Incidence Rates and 95% Confidence Intervals by Registry Group and Sex, 1988-1992[1]

Registry Group	Count	US Standard		World Standard	
		Rate	95% CI	Rate	95% CI
TOTAL					
Chinese					
US[2]	475	10.9	9.8-12.0	8.4	7.6-9.2
China[3]	20497	37.2	36.6-37.7	29.0	28.6-29.4
HK[4]/Singapore	6753	20.2	19.7-20.7	15.5	15.1-15.9
Japanese					
US	986	22.0	20.4-23.6	16.1	15.0-17.3
Japan[5]	54484	61.5	60.9-62.0	48.2	47.8-48.6
Filipino					
US	280	6.5	5.7-7.4	5.0	4.4-5.6
Manila	858	11.0	10.2-11.8	8.4	7.8-9.0
MALES					
Chinese					
US	282	14.6	12.8-16.4	11.3	9.9-12.7
China	13720	54.2	53.2-55.1	41.6	40.9-42.3
HK/Singapore	4239	28.1	27.2-29.0	21.4	20.7-22.0
Japanese					
US	584	29.5	26.9-32.3	21.6	19.7-23.6
Japan	35214	92.9	91.9-93.8	71.8	71.1-72.6
Filipino					
US	162	7.8	6.6-9.2	6.0	5.0-7.0
Manila	493	14.8	13.4-16.3	11.0	10.0-12.1
FEMALES					
Chinese					
US	193	7.6	6.4-8.8	5.8	4.9-6.8
China	6777	23.0	22.4-23.6	18.2	17.8-18.7
HK/Singapore	2514	13.7	13.1-14.2	10.4	10.0-10.8
Japanese					
US	402	15.7	14.0-17.6	11.7	10.4-13.0
Japan	19270	38.2	37.7-38.7	30.0	29.5-30.4
Filipino					
US	118	5.4	4.4-6.5	4.2	3.4-5.0
Manila	365	8.2	7.3-9.1	6.4	5.7-7.1

1 Data are not shown for rates based on fewer than 5 cases.
2 US = SEER + California
3 China = Shanghai + Tianjin
4 HK = Hong Kong + Singapore Chinese
5 Japan = Miyaki, Osaka, Saga, Yamagata, Nagasaki

Five-Year Counts, Average Annual Age-Specific Incidence Rates and 95% Confidence Intervals by Registry Group, Age, and Sex, 1988-1992[1]

Age Group	MALES			FEMALES		
	Count	Rate	95% CI	Count	Rate	95% CI
US[2]-Chinese						
0-19	<5	-	-	<5	-	-
20-34	7	1.2	0.5-2.5	11	1.9	0.9-3.3
35-49	21	4.4	2.7-6.8	21	4.1	2.5-6.2
50-64	75	29.0	22.8-36.3	39	14.2	10.1-19.4
65+	179	97.4	83.7-112.8	122	56.1	46.6-66.9
China[3]						
0-19	<5	-	-	<5	-	-
20-34	313	3.8	3.4-4.3	366	4.9	4.5-5.5
35-49	1017	15.9	14.9-16.9	775	13.4	12.5-14.4
50-64	4547	107.4	104.3-110.6	2017	45.4	43.4-47.4
65+	7841	345.8	338.2-353.6	3615	131.2	127.0-135.6
Hong Kong/Singapore Chinese						
0-19	<5	-	-	<5	-	-
20-34	82	1.4	1.1-1.7	107	1.9	1.5-2.3
35-49	394	9.3	8.4-10.3	272	7.1	6.3-8.0
50-64	1381	53.4	50.6-56.3	566	23.7	21.8-25.8
65+	2378	175.4	168.4-182.6	1565	87.9	83.6-92.3
US-Japanese						
0-19	<5	-	-	<5	-	-
20-34	<5	-	-	5	1.3	0.4-3.0
35-49	30	8.9	6.0-12.7	25	7.0	4.5-10.3
50-64	104	46.0	37.6-55.7	111	32.7	26.9-39.4
65+	445	210.3	191.3-230.8	261	100.5	88.6-113.4
Japan[4]						
0-19	6	0.1	0.0-0.1	10	0.1	0.1-0.2
20-34	246	3.3	2.9-3.8	317	4.3	3.8-4.7
35-49	3378	40.0	38.7-41.4	2454	28.7	27.6-29.9
50-64	12849	195.3	192.0-198.7	5024	72.5	70.5-74.5
65+	18735	564.1	556.1-572.2	11465	226.3	222.2-230.5
US-Filipino						
0-19	<5	-	-	<5	-	-
20-34	<5	-	-	<5	-	-
35-49	17	3.5	2.0-5.6	21	3.5	2.1-5.3
50-64	32	13.2	9.0-18.7	24	7.7	4.9-11.4
65+	112	57.1	47.0-68.7	72	35.6	27.9-44.9
Manila						
0-19	<5	-	-	<5	-	-
20-34	30	0.9	0.6-1.3	26	0.7	0.5-1.1
35-49	75	4.4	3.5-5.6	60	3.5	2.7-4.6
50-64	154	21.3	18.0-24.9	119	14.8	12.3-17.7
65+	232	98.6	86.4-112.2	160	49.6	42.2-57.9

1 Data are not shown for rates based on fewer than 5 cases.
2 US = SEER + California
3 China = Shanghai + Tianjin
4 Japan = Miyaki, Osaka, Saga, Yamagata, Nagasaki