

## 2.7 Cancer of the stomach

A possible relationship between alcoholic beverage consumption and risk for stomach cancer has long been hypothesized, but epidemiological evidence has been considered uncertain (IARC, 1988). This section evaluates the human evidence related to the risk for stomach cancer based on relevant publications from cohort and case-control studies published since 1988. Because a large proportion of cases of stomach cancer occur in China (accounting for 38% throughout the world), papers published in the Chinese literature are also included in this review.

The effects of total alcoholic beverage consumption on the risk for stomach cancer are summarized in Table 2.36 (cohort studies), Table 2.37 (cohort studies in the Chinese literature), Table 2.38 (case-control studies) and Table 2.39 (case-control studies in the Chinese literature). The effects of alcoholic beverage consumption and risk for stomach cancer by anatomic subtypes (cardia and distal cancer) are shown in Table 2.40, the effects of alcoholic beverage types are presented in Table 2.41 and the effects of alcoholic beverage consumption and the risk for stomach cancer stratified by gender are given in Table 2.42.

### 2.7.1 Cohort studies

#### (a) Special populations (Table 2.36)

In the Danish cohort study of 18 368 alcohol abusers conducted in Copenhagen in 1954–87, 64 cases of stomach cancers occurred during follow-up (Tønnesen *et al.*, 1994). The SIR for stomach cancer was slightly increased and marginally significant (SIR, 1.3; 95% CI, 1.0–1.7). In the Swedish cohort of alcoholics (Adami *et al.*, 1992a), a total of 25 cases resulted in a null association and an SIR of 0.9 (95% CI, 0.6–1.4) for men and 0.7 (95% CI, 0.0–4.0) for women.

#### (b) General population (Tables 2.36 and 2.37)

A total of 12 cohort studies of the general population that were conducted in Japan, the USA, Sweden, China, Denmark and the United Kingdom have examined the association between alcoholic beverage consumption and stomach cancer; three studies reported a significant association. Two cohort studies reported a statistically significant association between alcoholic beverage consumption and the risk for stomach cancer (Kato *et al.*, 1992b; Fan *et al.*, 1996) and one study with a large sample size reported an inverse relationship (Tran *et al.*, 2005). Nine studies reported either a non-statistically significant association or no association.

**Table 2.36 Cohort studies of stomach cancer and alcoholic beverage consumption**

Reference, location, name of study	Cohort description	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of cases/deaths	Relative risk (95% CI)	Adjustment factors	Comments
<i>Special populations</i>								
Kono <i>et al.</i> (1987), Japan, Japanese Physicians' Study	5130 male Japanese physicians, aged 27–89 years; followed up for 19 years; 1965–	Self-administered questionnaire	ICD-8 (155) Primary liver cancer ICD-8 (151)	Never Occasional Daily (<2 g/day) Daily (≥2 g/day)	Total: 116 deaths	1.00 1.11 (0.69–1.79) 1.30 (0.79–2.12) 1.17 (0.66–2.07)	Age, smoking	Daily consumption of alcohol (1'go' sake) 1'go' =180 mL; 1'go' sake ≈ 27 mL alcohol
Adami <i>et al.</i> (1992a), Sweden, Uppsala Alcoholics Study	9353 (8340 men, 1013 women) selected from the Uppsala Inpatients Register with a discharge diagnosis containing a diagnostic code for alcoholism during 1965–83; follow-up, 19 years (mean, 7.7)	Follow-up was by record linkage to the nationwide Cause of Death Registry and the Swedish Cancer registry.	ICD-7 (155.0) Liver cancer; ICD-7 (307,322) ICD-8 (291,303)		Total, 24 cases 23 men 1 woman	<b>SIR</b> 0.9 (0.6–1.4) 0.7 (0.0–4.0)	-	Expected numbers of cancers computed from cancer incidence in the study population (Uppsala health care region) to compare with the observed

Table 2.36 (continued)

Reference, location, name of study	Cohort description	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of cases/deaths	Relative risk (95% CI)	Adjustment factors	Comments
Tønnesen <i>et al.</i> (1994), Denmark, Alcohol Abusers Study	18 368 alcoholics from Copenhagen who entered a public outpatient clinic for free treatment in 1954–87; 15 214 men observed for 12.9 years on average and 3093 women observed for an average of 9.4 years	Records of cohort members linked to the Danish Cancer Registry to obtain cancer morbidity information		Alcohol abuse (male, female alcoholics)	64 cases 60 men 4 women	<b>SIR</b> 1.3 (1.0–1.6) $p \leq 0.05$ 1.8 (0.5–4.6) $p \leq 0.05$	Age, sex	Observed cancer incidence compared with that expected in the Danish population

Table 2.36 (continued)

Reference, location, name of study	Cohort description	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of cases/deaths	Relative risk (95% CI)	Adjustment factors	Comments
Nomura <i>et al.</i> (1995), Hawaii, USA, American Men of Japanese Ancestry Study	8006 men born in 1900–19, and residing on the Hawaiian island of Oahu; followed up for 25 years examined between 1965–1968 at all hospitals on Oahu and the Hawaiian Tumor Registry	Interviewed; surveillance to identify incident cases		Non-drinker <5 oz/month 5–14 oz/month 15–39 oz/month ≥40 oz/month	86 cases 43 41 39 36	1.0 0.9 (0.6–1.3) 1.1 (0.8–1.6) 1.0 (0.7–1.5) 1.2 (0.8–1.8) <i>p</i> =0.20	Age, smoking history	

Table 2.36 (continued)

Reference, location, name of study	Cohort description	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of cases/deaths	Relative risk (95% CI)	Adjustment factors	Comments
<i>General population</i>								
Kneller <i>et al.</i> (1991), USA	17 633 white American men insurance policy holders, largely of Scandinavian and German descent, aged $\geq 35$ years; follow-up, 1966–86	Mailed questionnaire		Alcoholic beverage consumption (data not presented)	75 deaths	No association	-	Data regarding alcohol use and risk for stomach cancer not presented
Kato <i>et al.</i> (1992a), Japan	3914 subjects who underwent gastroscopic examination; 4.4 years of follow-up on average (1985–89)	Self-recorded questionnaire, cancer registry and death certificate	Organ site (ICD code)	None Past Occasional Daily	12 cases 6 11 16 Total: 45 (35 men, 10 women)	1.00 2.19 (0.78–6.19) 1.10 (0.47–2.60) 1.51 (0.65–3.54)	Sex, age, residence	Non-significant increase in risk for stomach cancer among past and daily drinkers

Table 2.36 (continued)

Reference, location, name of study	Cohort description	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of cases/deaths	Relative risk (95% CI)	Adjustment factors	Comments
Kato <i>et al.</i> (1992b), Japan	9753 Japanese men and women, aged $\geq 40$ and $\geq 30$ years, respectively; follow-up, 1986–91; response rate, 85.9%	Baseline survey using a mailed questionnaire; death certificate		None Occasional Daily <50 mL Daily $\geq 50$ mL	26 cases 12 7 12 Total: 57 (33 men, 22 women)	1.0 1.75 (0.84–3.61) 1.20 (0.48–3.00) 3.05 (1.35–6.91)	Sex, age	Association between alcohol intake and stomach cancer slightly weakened when smoking status, diet and family history of stomach cancer were included in the multivariate analysis.

**Table 2.36 (continued)**

Reference, location, name of study	Cohort description	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of cases/deaths	Relative risk (95% CI)	Adjustment factors	Comments
Guo <i>et al.</i> (1994), China, Lin Xian Nutrition Intervention Trial	Nested case-control study; 29 584 adults who participated in a randomized intervention trial, aged 40–69 years; follow-up, 1986–91; 539 cases, 2695 controls, 5 controls per case; matched by age, sex	Structured interview		Lifetime consumption of alcoholic beverages (data not presented)	539 cases			Drinking alcoholic beverages was relatively uncommon in this area, but was reported by 22% of the cancer patients; no significant association (data not presented)

Table 2.36 (continued)

Reference, location, name of study	Cohort description	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of cases/deaths	Relative risk (95% CI)	Adjustment factors	Comments
Murata <i>et al.</i> (1996), Japan, Chiba Center Association Study	Nested case-control study; 887 cases and 1774 controls, selected from a cohort of 17 200 male participants of a gastric mass survey in 1984; followed up for 9 years; 2 controls per case; matched by sex, birth year, first digit of the address code	Self-administered questionnaire		0 (cup/day) 0.1–1.0 (cups/day) 1.1–2.0 (cups/day) ≥2.1 (cups/day)	101 cases 82 51 12	1.0 1.1; $p>0.05$ 1.1; $p>0.05$ 0.5; $p>0.05$	Smoking	No 95% CI provided; a cup of 180 mL Japanese sake contains 27 mL ethanol.



Table 2.36 (continued)

Reference, location, name of study	Cohort description	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of cases/deaths	Relative risk (95% CI)	Adjustment factors	Comments
Yuan <i>et al.</i> (1997), China, Shanghai Men's Study	18 244 male residents of Shanghai, enrolled between 1986 and 1989 (80% of eligible subjects); only 50 subjects lost to follow-up until 1993	Structured interviewed; cancer incidence ascertained through the population-based Shanghai Cancer Registry and vital status ascertained by inspection of the Shanghai death certificate records		Non-drinkers 1–28 drinks/week ≥29 drinks/week	48 deaths 33 10	1.0 0.98 1.37	Age, education, smoking	95% CI not given; non-significant 30–40% increase in risks of death from cancers of the stomach observed in heavy drinkers.

**Table 2.36 (continued)**

Reference, location, name of study	Cohort description	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of cases/deaths	Relative risk (95% CI)	Adjustment factors	Comments
Terry <i>et al.</i> (1998), Sweden, Swedish Twin Registry Study	11 546 individuals born in 1886–1925 in the Swedish Twin Registry, and both still living in Sweden in 1961; followed up, 1967–92; 98% follow-up	Mailed questionnaire, record linkage to the National Cancer and Death Registers.	Organ site (ICD code)	None Light Moderate	116 cases	1.00 1.51 (0.89–2.55) 1.36 (0.83–2.24)	Fruit and vegetable intake, age, gender, body mass index, socioeconomic status, smoking	Alcoholic beverage consumption was assessed as number of drinks per week (data not presented); no. of cases per drinking category not given.
Sasazuki <i>et al.</i> (2002), Japan, The Japan Public Health Center Study Cohort I	19 657 men, born in 1930–49, aged 40–59 years at baseline; followed up, 1990–99; response rate: men, 76%; women, 82%	Self-administered questionnaire, death certificates, cancer registry	ICD-9 (151)	0–3 days/month 0–161.0 g/week 162.0–322.0 g/week 322.5 g/week	68 deaths 54 77 74	1.0 0.8 (0.6–1.2) 1.1 (0.8–1.5) 1.1 (0.8–1.6)	Age, area, smoking habit, consumption of fruit, green or yellow vegetables, salted cod roe or fish gut, body mass index	Reference group (0–3 days/month) included drinkers; data for women collected but not presented

**Table 2.36 (continued)**

Reference, location, name of study	Cohort description	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of cases/deaths	Relative risk (95% CI)	Adjustment factors	Comments
Tran <i>et al.</i> (2005), China, Linxian General Population Trial	29 584 adults who participated in the Linxian General Population Trial, 40–69 years of age at baseline; follow-up, 15 years (1984–98)	Structured interview; case ascertainment considered complete and loss to follow-up minimal (176 or 1%)		Alcoholic beverage consumption (data not presented)	1089  363	Gastric cardia cancer 0.84 (0.72–0.97); Gastric non-cardia cancer 0.79 (0.61–1.02)	Age, sex	Alcoholic beverage drinking defined as any in previous 12 months

CI, confidence interval; ICD, International Classification of Diseases; SIR, standardized incidence ratio

**Table 2.37 Cohort studies of stomach cancer and alcoholic beverage consumption published in the Chinese literature<sup>a</sup>**

Reference, study location, period	Characteristics of cases	Characteristics of cohort	Exposure assessment	Exposure categories	Relative risk (95% CI)	Adjustment factors	Comments
Fan <i>et al.</i> (1996), Sifang County, Shichuan, 1985–90	128 digestive tract cancers identified from the Disease Surveillance Spot, including stomach, liver, colorectal and oesophageal cancer; 97% diagnosed by county level hospitals	29 929 farmers, aged >35 years; age and sex distribution not provided; loss to follow-up not described	Interviewer-administered questionnaire (once a year)	<i>Cumulative alcohol consumption (kg)</i>	(Stomach cancer only)	Not mentioned	Relative risk for death from stomach cancer
				Non-drinkers	1.0		
				<i>Men</i>			
				1–125	2.53 (0.74–8.70)		
				125–500	3.89 (1.55–9.74)		
				≥500	6.28 (1.11–12.97)		
Wang <i>et al.</i> (2005a), Shanghai, 1986–2002	18 244 cancer-free men followed from 1986 to 2002	Interview	<i>Alcoholic beverages (g/day)</i>		Age, smoking, education		
			0	1.00			
			<30	1.00			
			30–70	1.16			
			>70	1.42			
				( <i>p</i> -value>0.05)			

CI, confidence interval

There was evidence of an association between alcohol consumption and an increased risk stomach cancer in the two cohort studies conducted in Japan (57 cases; Kato *et al.*, 1992b) and China (128 cases; Fan *et al.*, 1996). The relative risks for stomach cancer were 3.05 (95% CI, 1.35–6.91) for 50 mL or more alcohol per day (three or more drinks per day) when adjusted for age and gender (Kato *et al.*, 1992b) and 6.28 (95% CI, 1.11–12.97) for men who had a cumulative alcoholic beverage consumption of 500 kg or more (Fan *et al.*, 1996). One cohort study in China with a large sample size (1089 cardia cancer and 363 non-cardia cancer) reported inverse associations with alcoholic beverage consumption, with relative risks of 0.84 (95% CI, 0.72–0.97) for cardia cancer and 0.79 (95% CI, 0.61–1.02) for non-cardia cancer (Tran *et al.*, 2005). The two studies that reported a positive association (Kato *et al.*, 1992b; Fan *et al.*, 1996) adjusted for age and gender, but it is not clear what confounding factors were adjusted for in the study by Tran *et al.*, (2005).

A positive, but not statistically significant, association was observed in five studies (Kono *et al.*, 1987; Kato *et al.*, 1992a; Yuan *et al.*, 1997; Terry *et al.*, 1998; Wang *et al.*, 2005a) and null results were reported in three studies with relatively large sample sizes ranging from 75 to 493 cases (Kneller *et al.*, 1991; Nomura *et al.*, 1995; Murata *et al.*, 1996; Sasazuki *et al.*, 2002).

### 2.7.2 Case–control studies (Tables 2.38 and 2.39)

Several case–control studies have reported results on the influence of alcoholic beverage consumption on the risk for stomach cancer. More than 50% of the studies reported a positive association between alcoholic beverage consumption and stomach cancer: 60% of the studies that adjusted for confounding factors and 52% of the studies that did not also report a positive association. The proportion of positive associations was 71% in the Chinese literature and 44% in the English literature.

In more than half of the studies, the odds ratios were adjusted for variables such as sex, age, residence, education, diet, socioeconomic status and cigarette smoking. Odds ratios were adjusted for *Helicobacter pylori* status in one study (Kikuchi *et al.*, 2002). In 25 case–control studies, of which 11 were published in English (Lee *et al.*, 1990; Boeing *et al.*, 1991; Jedrychowski *et al.*, 1993; Falcao *et al.*, 1994; Inoue *et al.*, 1994; Ji *et al.*, 1996; De Stefani *et al.*, 1998a; Zaridze *et al.*, 2000; Muñoz *et al.*, 2001; Kikuchi *et al.*, 2002; Shen *et al.*, 2004), an association was found between stomach cancer and alcoholic beverage consumption. The point estimates of adjusted odds ratios for an association between alcoholic beverage consumption and the risk for stomach cancer were between 2.4 and 2.8 for 2–3 drinks per day.

### 2.7.3 Anatomic subsite and histological type (Table 2.40)

Among 12 case–control studies of both cardia cancer and distal stomach cancer, eight demonstrated a stronger association for cardia cancer than for distal stomach

Table 2.38 Case-control studies of stomach cancer and alcoholic beverage consumption

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Relative risk (95% CI)	Adjustment factors	Comments
Lee <i>et al.</i> (1990), Taiwan, China, 1954–88	210 (123 men, 87 women); histologically confirmed; adenocarcinoma, 97.7%; other type of carcinoma, 2.3%; participation rate, 90%; death certificate from Taiwan Provincial Department of Health	810 (478 men, 332 women) from ophthalmic service in four major hospitals in Taipei; matched with cases on hospital, age, sex; participation rate, 96%	Interviewer-administered structured questionnaire		<i>Days/week</i> None 1–3 ≥4	150 21 39	1.0 0.93 1.51; $p < 0.05$	Smoking; green tea drinking, salted meat consumption, fried food consumption, fermented bean consumption, milk consumption	Frequency and duration of alcoholic beverage drinking both associated with stomach cancer; dose-response relationship
Boeing <i>et al.</i> (1991), Germany, 1985–88	143 incident, almost equal number of men and women, aged 32–80 years; histologically confirmed; patients from 5 hospitals in Germany	579 hospital patients and visitors; matched by 2:1 match by age ( $\pm 3$ years), sex	Interviewer-administered standardized questionnaire		<i>Beer</i> None <100 g/day 100–500 g/day >500 g/day  <i>Wine</i> None <20 g/day >20 g/day  <i>Liquor</i> None <2 g/day >2 g/day	37 24 50 32  69 53 21  107 22 14	1.0 1.12 (0.62–2.01) 2.22 (1.30–3.77) 1.82 (0.95–3.50) $p < 0.05$  1.0 0.94 (0.61–1.45) 0.52 (0.30–0.93) $p < 0.05$  1.0 0.75 (0.43–1.29) 0.52 (0.27–1.00) $p < 0.05$	Age, sex, hospital	Beer is the dominant alcoholic beverage in the study area.

Table 2.38 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Relative risk (95% CI)	Adjustment factors	Comments				
Hoshiyama & Sasaba (1992a,b), Saitama, Japan, 1984–90	216 single and 35 multiple, newly diagnosed stomach adenocarcinomas (men); participation rate, 73%	483 randomly selected from electoral roll; stratification by sex, age; participation rate, 28%	Interviewer-administered standardized questionnaire		<b>Single stomach cancer</b>			Age, smoking status	No association between single and multiple stomach cancer risk and alcoholic beverage consumption				
					Never	33	1.0						
					Past	11	1.0 (0.4–2.2)						
					Occasional	48	1.0 (0.6–1.7)						
					Daily	124	1.0 (0.6–1.6)						
					<i>Total alcohol consumption (mL/lifetime)</i>								
					Non-drinker					1.0			
					<500 000					0.9 (0.6–1.6)			
					≥500 000					1.1 (0.7–1.9)			
					<b>Multiple stomach cancer</b>								
					Never					1.0			
					Past					4.7 (1.0–21.6)			
					Occasional					2.6 (0.7–9.6)			
Daily			1.4 (0.4–5.2)										
<i>Total alcohol consumption (mL/lifetime)</i>													
Non-drinker			1.0										
<500 000			1.7 (0.4–6.4)										
≥500 000			2.5 (0.7–9.3)										

Table 2.38 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Relative risk (95% CI)	Adjustment factors	Comments
Jedrychowski <i>et al.</i> (1993), Poland, 1986–90	520 men, aged <75 years; histologically confirmed, classified according to the Lauren criteria; 137 cardia (58% intestinal, 20% diffuse type), 383 non-cardia (51.2% intestinal, 36% diffuse type); participation rate, 100%	520 men from nine university hospitals in Poland admitted mostly for accidents, orthopaedic problems or general surgery; matched by age ( $\pm 5$ years); disease of gastrointestinal tract and other cancers excluded; participation rate, 100%	Interviewer-administered standardized questionnaire		<i>Average quantity of vodka per occasion</i>			Hospital, age, sex, occupation, education, sausage consumption, fruit/vegetable consumption, smoking	Non-drinkers: abstainers or who reported drinking vodka occasionally but less than 100 g at a time; those who drank vodka before breakfast had a nearly threefold elevated risk; findings on alcoholic beverages other than vodka not reported.
					Non-drinker	68	1.0		
					100 g	85	1.99 (1.23–3.23)		
					250 g	208	2.01 (1.33–3.05)		
					>250 g	159	2.43 (1.57–3.75)		
							$p < 0.001$		
					<i>Frequency of vodka drinking</i>				
					Non-drinker	68	1.0		
					Very rare (<1/month)	132	1.83 (1.18–2.83)		
					1–3/month	205	2.09 (1.38–3.16)		
$\geq 1$ /week	115	3.06 (1.90–4.95)							
		$p < 0.001$							
<i>Vodka drinking on an empty stomach</i>									
Non-drinker	68	1.0							
Not drinking before breakfast	401	2.09 (1.42–3.08)							
Drinking before breakfast	51	2.98 (1.60–5.53)							
		$p < 0.001$							



Table 2.38 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Relative risk (95% CI)	Adjustment factors	Comments
Kabat <i>et al.</i> (1993), USA, 1981–90	Adenocarcinoma of the oesophagus/cardia (160 men, 21 women), squamous-cell carcinoma of the oesophagus (122 men, 78 women), adenocarcinoma of distal stomach (113 men, 30 women); newly diagnosed, histologically confirmed	Hospitalized patients with disease not related to smoking and of organ systems other than the gastrointestinal tract (4162 men, 2222 women); matched by age ( $\pm 5$ years), sex, race, hospital	Interviewer-administered structured questionnaire; all subjects were interviewed in 28 hospitals in eight cities in the USA between 1981 and 1990	ICD-9 (150, 151.0, 151.1–151.9)	<b>Adenocarcinoma of distal stomach</b> <i>Men</i> Non-drinker Occasional 1–3.9 oz WE/day $\geq 4$ WE/day <i>Women</i> Non-drinker Occasional 1–3.9 oz WE/day $\geq 4$ WE/day		1.0 1.0 (0.6–1.7) 0.5 (0.3–0.9) 0.7 (0.4–1.3) 1.0 0.6 (0.3–1.4) 0.6 (0.2–1.8) 0.9 (0.3–3.1)	Age education, smoking, hospital, time period (1981–84, 1985–90)	Non-drinker: less than 1 drink per week; occasional: $\geq 1$ drink per week but < 1 drink per day; WE: whiskey-equivalent; analysis limited to whites; joint effect of smoking and drinking (analysis limited to men), 0.9 (0.5–1.5) for adenocarcinoma of distal stomach and 2.4 (1.3–4.2) for oesophagus/cardia
D'Avanzo <i>et al.</i> (1994), Milan, Italy, 1985–93	746 (457 men, 289 women), aged 19–74 years; histologically confirmed incident; refusal rate, 5%; admitted to National Cancer Institute; 5 major hospitals in Milan	2053 hospitalized (1205 men, 848 women) for acute non-neoplastic non-digestive tract disease, aged 19–74; >90% from Italy; refusal rate, 5%;	Interviewer-administered standardized questionnaire		Non-drinkers <2 drinks/day 2<4 drinks/day 4<6 drinks/day 6<8 drinks/day $\geq 8$ drinks/day  <i>Duration (years)</i> Non-drinkers <30 $\geq 30$	187 115 199 109 52 84  187 132 427	1.0 1.1 (0.9–1.5) 1.1 (0.9–1.4) 1.1 (0.8–1.5) 1.3 (0.9–1.9) 1.6 (1.1–2.2) $p < 0.05$ 1.0 1.1 (0.9–1.4) 1.2 (1.0–1.6) $p < 0.05$	Sex, age, education	Conditions of controls: traumatic diseases, 47%; non-traumatic orthopaedic, 20%; acute surgical, 19%; other miscellaneous disorders, 14%

Table 2.38 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Relative risk (95% CI)	Adjustment factors	Comments
Falcao <i>et al.</i> (1994), Portugal	74 selected from patients undergoing gastroscopy; histologically confirmed	193 patients undergoing gastroscopy or colonoscopy or other recto-sigmoidal procedure; patients accompanying patients; matched for age ( $\pm 5$ years), sex	Interviewer-administered structured questionnaire		<i>Red wine consumed per week (g of alcohol)</i>		1.0		
					<187	1.36 (0.64–2.93)			
					187–372	1.77 (0.63–4.98)			
					373–559	3.67 (1.42–9.49)			
Hansson <i>et al.</i> (1994), central and northern Sweden, 1989–92	338 (218 men, 120 women), aged 40–79 years; histologically confirmed; 74.1% of original sample	679 randomly selected from population registers; mean age, 67 years; 1:2 frequency-matched by age strata, sex; participation rate, 77.3%	Interviewer-administered structured questionnaire		<i>Total alcohol consumption (mL 100% alcohol/month)</i>			Age, gender, socioeconomic status	High alcohol intake tended to increase the risk associated with tobacco use; among non-drinkers, odds ratio for tobacco use was 0.53 (0.25–1.12) and, among drinkers, was 1.77 (1.22–2.57) ( $p=0.0073$ )
					Non-drinkers	83	1.0		
					1–35	95	1.17 (0.81–1.70)		
					36–160	87	1.11 (0.75–1.64)		
					>160	73	0.92 (0.60–1.42) $p=0.64$		

Table 2.38 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Relative risk (95% CI)	Adjustment factors	Comments
Inoue <i>et al.</i> (1994), Nagoya, Japan, 1988–91	668 (420 men, 248 women); histologically confirmed; 123 cardia, 218 middle (body), 256 antrum, 71 unclassified	668 (420 men, 248 women) with no history of cancer or any other specific disease, randomly selected from outpatients at same hospital; matched by sex, age ( $\pm$ 2 years), time of hospital visit	Common self-administered questionnaire	ICD-9 (151.0–151.9)	Drinker (versus non-drinker)		1.23 (0.92–1.65)	Sex	Joint effect of smoking and drinking: 1.97 (1.14–3.42); especially in the development of cardia cancer, 4.70 (1.10–20.2); drinkers included 'ex-drinkers'; only data for men were presented.
					Current drinker		1.16 (0.86–1.56)		
					Former drinker		1.87 (1.11–3.15)		
					<1 year after quitting		2.60 (1.09–6.19)		
					$p < 0.05$				
					$\geq 1$ year after quitting		1.60 (0.87–2.94)		

Table 2.38 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Relative risk (95% CI)	Adjustment factors	Comments
Gajalakshmi & Shanta (1996), India, 1988–90	388 incident (287 men, 101 women); 75% confirmed histologically, 25% by barium meal, exploratory surgery or endoscopy	287 men and 101 women cancer patients from Cancer Institute, diagnosed in 1988–90; site of cancer: penis, 23.5%; bone and connective tissue, 15.2%; skin, 13.1%; cervix, 11.9%; leukaemia, 6.2%; prostate, 6.2%; breast, 5.2%; other sites, 18.7%; 1:1 matched by age ( $\pm$ 5 years), sex, religion, mother tongue; cancers of gastrointestinal tract, bladder and pancreas and smoking-related cancers excluded	Interviewer-administered standardized questionnaire		Non-drinkers Former drinkers Current drinkers Former and current	285 37 66 103	1.0 1.4 (0.54–3.40) 0.8 (0.41–1.77) 1.1 (0.58–1.95)	Chewing habit, income group, education, residence (multivariate model)	Controls were cancer patients.

Table 2.38 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Relative risk (95% CI)	Adjustment factors	Comments				
Ji <i>et al.</i> (1996), Shanghai, China, 1988–89	1124 (770 men, 354 women), aged 20–69 years; 52.1% confirmed histologically, 48% by surgery, endoscopy, X-rays or ultrasound as cancer of cardia (16%), distal stomach (70%) or unclassified (14%); participation rate, 65.5%	1451 (819 men, 632 women) randomly selected permanent residents in Shanghai; frequency-matched for age, sex; participation rate, 85.8%	Interviewer-administered structured questionnaire	ICD-9 (151.0, 151.1–151.8, 151.9)	<i>Ethanol intake (g/week)</i>					Age, income, education, smoking	Risk for distal cancer among men increased more than twofold (odds ratio, 2.21; 95% CI, 1.28–3.82) for users of both tobacco and alcohol relative to non-users but no statistically significant interaction between lifetime amounts of smoking and alcoholic beverage drinking; data for women not presented.		
					<i>Men</i>								
					<175	75	1.02 (0.71–1.49)						
					175–349	80	1.00 (0.70–1.43)						
					350–524	79	1.08 (0.75–1.53)						
					≥525	79	1.19 (0.84–1.68)						
					<i>Non-drinker</i>		483	1.0					
					<i>Former drinker</i>		27	1.91 (1.16–3.15)					
					<i>Current drinker</i>		307	1.04 (0.84–1.30)					
					<i>Duration (years)</i>								
					<15	100	0.80 (0.57–1.13)						
					15–< 34	113	1.21 (0.90–1.63)						
					≥35	121	1.30 (0.96–1.75)						
<i>Lifetime ethanol intake (g/week × years)</i>													
<2450	76	0.68 (0.46–1.02)											
2450–7462	79	1.37 (0.98–1.93)											
7463–15 399	79	0.87 (0.60–1.25)											
≥15 400	78	1.39 (0.99–1.95)											
					<i>p</i> =0.12								

Table 2.38 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Relative risk (95% CI)	Adjustment factors	Comments
Zhang <i>et al.</i> (1996), USA, 1992–94	95 (79 men, 16 women) incident with pathological diagnosis of adenocarcinomas of oesophagus and gastric cardia, 67 (43 men, 24 women) with adenocarcinoma of the distal stomach; participation rate, 81%	132 (62 men, 70 women) consecutive patients scheduled to have an upper gastrointestinal endoscopy in the cancer centre and later classified as cancer-free; participation rate, 81%	Self-administered modified National Cancer Institute Health Habits History Questionnaire	ICD-0 (150.0–150.9; 151.0, 151.1–151.9)	<i>ACDS</i>	20	1.00	Age, sex, race, education, pack-years of smoking, body mass index, total dietary intake of calories	Frequency of self-reported alcohol use multiplied by 0.5 if patient's portion size was small; by 1 if the portion size was medium; and by 1.5 if the portion size was large.
					No	20	1.60 (0.65–3.93)		
					$\leq 1/\text{week}$	27	0.98 (0.43–2.27)		
					$> 1/\text{week}$		$p=0.93$		
					<i>ACOGC</i>	14	1.0		
No	26	3.02 (1.14–8.02)							
	55	2.02 (0.85–4.82)		$p=0.19$					
Gammon <i>et al.</i> (1997), Connecticut, USA, 1993–95	Gastric cardia adenocarcinomas (223 men, 38 women), other gastric adenocarcinomas (254 men, 114 women); aged 30–79 years; histologically confirmed, newly diagnosed; all identified by use of established rapid-reporting systems	695 (555 men, 140 women) identified by Waksberg's random-digit dialling, aged 30–64 years; frequency-matched by age, sex; overall response rate, 70.2%	Structured questionnaire administered by trained interviewers		<i>Any intake</i>		<i>Gastric adenocarcinoma</i>	Age, sex, geographical centre, race, body mass index, income, cigarette smoking, all other types of alcohol use	Interviews administered directly to the study subject, rather than to the closest next of kin (usually the spouse) for more than 67% of cases and 96% of controls
					Never	125	1.0		
					Ever	238	0.8 (0.6–1.1)		
					$< 5$ drinks/week	74	0.7 (0.5–1.1)		
					5–11 drinks/week	68	0.9 (0.6–1.3)		
					12–30 drinks/week	55	0.7 (0.4–1.0)		
					$> 30$ drinks/week	41	0.6 (0.4–1.0)		

Table 2.38 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Relative risk (95% CI)	Adjustment factors	Comments
Muñoz <i>et al.</i> (1997), northern Italy, 1985–92	88, aged <75 years (median age, 62 years) reported a family history of stomach cancer in first degree relatives; refusal rate <3%	103 hospital controls (median age, 57 years) reported a family history of stomach cancer in first degree relatives; 80% of cases and controls resided in the same region and >90% in northern Italy.	Structured interview		<1 day/week 1–3 days/week ≥4 days/week	26 31 31	1.0 0.61 (0.34–1.42) 0.73 (0.27–1.98)	Sex, age, residence, education	88 cases and 103 controls reported a family history of stomach cancer in first degree relatives.
DeStefani <i>et al.</i> (1998a), Montevideo, Uruguay, 1992–96	331 men, aged 25–84 years; admitted to any of four major hospitals in Montevideo; 311 microscopically confirmed adenocarcinoma of stomach; 77.2% located in the antrum and pylorus; response rate, 92.8%	622 hospitalized men; frequency-matched by age, residence; response rate, 92.6%	Interviewer-administered standardized questionnaire		<i>Total alcohol consumption</i> Non-drinkers 1–60 g 61–120 g >120	64 70 65 112	1.0 1.0 (0.7–1.5) 1.5 (0.9–2.3) 2.4 (1.6–3.7) <i>p</i> <0.001	Age, residence, smoking, vegetable intake	Pure alcohol content was calculated according to concentrations specific to Uruguay: 6% for beer; 12% for wine and 46% for spirits.

Table 2.38 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Relative risk (95% CI)	Adjustment factors	Comments
López-Carrillo <i>et al.</i> (1998), Mexico (no study dates given)	220 (44.5% women 55.4% men), aged 24–88 years; histologically confirmed adenocarcinoma of the stomach from 15 large hospitals	752 (60.6% women, 39.4% men) population-based, aged 20–98 years; surrogate responders, 7%	Structured interview		<i>Ethanol (g/day)</i> Abstainers <1.5 1.5–4.9 ≥5.0	91 23 59 47	1.0 1.01 (0.52–1.96) 1.27 (0.76–2.11) 1.93 (1.00–3.71) <i>p</i> =0.068	Age, sex, total calorie intake, chili pepper, history of peptic ulcer, socioeconomic status, cigarette smoking, fruit, vegetables, salt, processed meats	One drink (1 oz or 30 mL) of tequila = 14.03 g ethanol; one drink (200 mL can/bottle) of beer = 12.96 g; one drink (60 mL) of wine = 9.58 g; and one drink of rum or brandy (30 mL) = 14.03 g ethanol; cases represented 80% of stomach cancer cases reported to the Mexican National Cancer Registry



Table 2.38 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Relative risk (95% CI)	Adjustment factors	Comments
Chow <i>et al.</i> (1999), Warsaw, Poland, 1994–97	464 (302 men, 162 women) from 22 hospitals in Warsaw, aged 21–79 years; confirmed histologically mainly as intestinal (67%) or diffuse (14%); participation rate, 90%	480 (314 men, 166 women) Warsaw residents randomly selected from a computerized registry of all legal residents in Poland; frequency-matched by age, sex; participation rate, 82%	Interviewer-administered standardized questionnaire; a 30-mL blood sample collected	(ICD-0; I51 ICD-0-2 C16)	Current non-drinker	170	1.0	Age, education, years lived on a farm, pack-years of cigarette smoking, history of cancer	Current drinking of beer, wine or liquor was inversely related to risk for stomach cancer among men but not women.
					<1 drink/week	41	0.7 ( 0.4–1.2)		
					1–<3 drinks/week	42	0.5 ( 0.3–0.9)		
					3–<7 drinks/week	32	0.4 ( 0.2–0.7)		
					≥7 drinks/week	79	1.2 ( 0.7–2.0)		
					<i>Age started (years)</i>				
					<20	81	0.5 ( 0.3–0.8)		
					20–24	66	0.5 ( 0.3–0.9)		
					≥25	44	1.0 ( 0.6–1.7)		
					<i>Drink-years</i>				
					<10	72	0.6 ( 0.4–0.9)		
					10–19	29	0.5 ( 0.3–0.9)		
					20–29	20	0.6 ( 0.3–1.3)		
30–39	12	0.5 ( 0.2–1.3)							
40–79	32	1.3 ( 0.6–2.6)							
≥80	27	1.0 ( 0.5–2.0)							
Ye <i>et al.</i> (1999), northern and central Sweden, 1989–95	90 (71 men, 19 women) gastric cardia cancer, 260 (190 men, 70 women) and 164 (87 men, 77 women) distal gastric cancer of intestinal and diffuse types, aged 40–79 years; histologically confirmed; participation rate, 62%	1164 (779 men, 385 women) randomly selected from population registers, aged 40–79 years; frequency-matched by age, sex; participation rate, 76%	Interviewer-administered structured questionnaire		<i>Total alcohol consumption (mL 100% alcohol/month)</i>			Age, gender, residence area, body mass index, socioeconomic status, smoking, use of smokeless tobacco, use of different kinds of alcoholic beverages	Interviewed about lifetime smoking, use of smokeless tobacco and use of alcohol 20 years ago
					Non-drinkers	52	<i>Intestinal type</i> 1.0		
					1–35	64	1.2 ( 0.8–1.9)		
					36–160	73	1.2 ( 0.8–1.9)		
					>160	66	1.2 ( 0.7–1.9) <i>p</i> =0.56		
							<i>Diffuse type</i>		
					Non-drinkers	36	1.0		
					1–35	50	1.3 ( 0.8–2.1)		
					36–160	42	1.0 ( 0.6–1.7)		
					>160	34	1.0 ( 0.5–1.8) <i>p</i> =0.73		

Table 2.38 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Relative risk (95% CI)	Adjustment factors	Comments
Zaridze <i>et al.</i> (2000), Moscow, Russia, 1996–97	448 (248 men, 200 women), aged <75 years; confirmed histologically as cancer of cardia (92) or non-cardia (356); lived in Moscow city; participation rate, 98%	610 (292 men, 318 women) patients restricted to Moscow city residents; conditions included respiratory (10%) and heart (10%) diseases, diseases of the nervous system (10%) and hypertension and stroke (9%); cancer and/or gastrointestinal diseases excluded; participation rate, 97%	Self-administered questionnaire; blood samples		<i>Gastric cardia</i>		<i>Men</i>	Age, education, smoking	There was an effect of interaction between smoking and vodka consumption on the risk for cardia cancer.
					Never	4	1.0		
					Ever	56	2.7 (0.9–8.3)		
					<i>Women</i>				
					Never	14	1.0		
					Ever	18	0.8 (0.4–1.9)		
					<i>Non-gastric</i>				
					Never	20	1.0		
Ever	168	1.7 (1.1–3.2)							
<i>Women</i>									
Never		1.0							
Ever		1.3 (0.8–1.9)							

Table 2.38 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Relative risk (95% CI)	Adjustment factors	Comments
Muñoz <i>et al.</i> (2001), Venezuela, 1991–97	292, aged >35 years; histologically confirmed; non-epithelial tumours of the stomach excluded	485 (119 hospital, 366 neighbourhood); 1:2 matched by age ( $\pm 5$ years), sex	Structured interview		Never/occasional Current Former	89 76 42	<i>Men</i> 1.0 2.9 (1.9–4.3) 3.5 (2.0–6.0)	Age, socioeconomic status	Only 1/143 female controls reported being an ever drinker; analysis of alcoholic beverage consumption therefore confined to men; most common forms of alcohol consumed were beer and aguardiente (sugar cane spirit): 69% of men who were current or former drinkers drank beer, 52% drank aguardiente and 28% drank other alcoholic drinks.

Table 2.38 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Relative risk (95% CI)	Adjustment factors	Comments
Wu <i>et al.</i> (2001), Los Angeles, USA, 1992–97	277 cancer of cardia (231 men, 46 women), 443 distal stomach (261 men, 182 women), aged 30–74 years; histologically confirmed; participation rate, 56%	1356 whites, latinos, African-Americans and Asian Americans (999 men, 357 women); matched by sex, race, date of birth, ethnicity; neighbourhood control subject was sought by use of a systematic algorithm based on the address of the case patient; diagnosis of stomach or oesophageal cancer excluded	Interviewer-administered structured questionnaire, completed by 55% of those identified and 77% of those approached		<i>Gastric cardia</i>			Age, sex, smoking, race, birth place, education	Race: whites, African-Americans, latinos and Asian Americans
					Never	48	1.0		
					Former	118	0.91 (0.6–1.4)		
					Current	109	0.98 (0.7–1.5)		
					<i>Distal</i>				
					Never	148	1.0		
					Former	150	0.85 (0.6–1.2)		
					Current	194	0.96 (0.7–1.3)		

Table 2.38 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Relative risk (95% CI)	Adjustment factors	Comments	
Hamada <i>et al.</i> (2002), Sao Paulo, Brazil, Japanese ancestry, 1991–94	96 (60 men, 36 women) of Japanese ancestry; aged 38–89 years; histologically confirmed; among 87 cases with known location, 80 tumours (92%) were in the lower portion ( body or antrum); no patients refused the interview	192 (120 men, 72 women) patients; 80 of 192 patients recruited voluntarily from the Japanese community in Sao Paulo; matched by age ( $\pm 5$ years), sex	Interviewer-administered standardized questionnaire; 15-mL blood sample		<i>Consumption frequency</i>			Country of birth	Alcohol consumption not associated with risk for stomach cancer	
					<1/month	68	1.0			
					1 day/month–4 days/week	17	1.7 (0.8–3.9)			
					Daily	11	1.8 (0.7–4.7) $p = 0.16$			
					<i>Lifetime alcohol consumption</i>					
					<1000 g	84	1.0			
1000–2000 g	2	0.5 (0.1–2.7)								
>2000 g	8	2.0 (0.6–2.5) $p = 0.38$								
Kikuchi <i>et al.</i> (2002), Tokyo, Japan, 1993–95	718 (494 men, 224 women), aged <70 years; histologically confirmed; classified by type (intestinal or diffuse), stage (early or advanced) and subsite of the lesions (proximal, middle or distal)	883 (448 men, 435 women) recruited from several health check programmes in a hospital in the same area between June 1993 and November 1994	Self-administered questionnaire; sera provided		<i>Alcohol–years<sup>a</sup></i>			<i>Men</i>	Age, smoking, <i>Helicobacter pylori</i> status	Alcohol–years (mL intake of pure alcohol per day multiplied by years of drinking); a J- or U-shaped effect on risk for stomach cancer; models designated ‘occasional’ drinker as reference or ‘never’ drinker as reference
					0 (never drinker)	34	1.89 (0.97– 3.69)			
					Occasional (1–134.9)	31	1.0			
					135–1349.9	90	2.82 (1.63– 4.86)			
					$\geq 1350$	138	2.84 (1.97–4.83)			
					<i>Women</i>					
					0 (never drinker)	57	1.54 (0.90–2.63)			
					Occasional (0.1–134.9)	29	1.0			
$\geq 135.0$	15	1.39 (0.66–2.93)								

Table 2.38 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Relative risk (95% CI)	Adjustment factors	Comments
Nishimoto <i>et al.</i> (2002), Sao Paulo, non-Japanese Brazilians, 1991–94	236 (170 men, 66 women) with no Asian background, aged 40–79 years; 78% white; no refusal to be interviewed	236 (170 men, 66 women) hospital-based; matched by age ( $\pm 5$ years), sex; 86.4% white; refusal rate, 8.4%	Interviewer-administered standardized questionnaire; 15-mL blood sample		<i>Consumption frequency</i>			Race (white or non-white), education, fruit and vegetable intake	Alcohol consumption not associated with risk for stomach cancer; the association did not change when analysis restricted to men.
					<1/month	158	1.0		
					1 day/month–4 days/week	29	0.4 (0.2–0.8)		
					Daily	49	1.1 (0.7–1.9) $p=0.93$		
					<i>Lifetime alcohol consumption</i>				
					<1000 g	173	1.0		
1000–2000 g	10	1.9 (0.6–5.9)							
>2000 g	41	1.0 (0.6–1.6) $p=0.88$							
Shen <i>et al.</i> (2004), China, 1997–98	165 (110 men, 55 women), aged 34–81 years; 108 intestinal-type gastric cancer, 57 gastric cardia cancer; identified by endoscopic and pathological diagnosis	295 (190 men, 105 women) healthy cancer-free subjects living in the same community, either siblings of cases or non-blood relatives (spouses and spouses' siblings of same gender as cases), aged 30–78 years	Interviewer-administered structured questionnaire; blood sample		Never	97	1.00	Age, gender	Possible recruitment bias in the selection of controls including cases' siblings
					Current	18	0.18 (0.10–0.35)		
					Past	50	1.80 (1.06–3.08) $p<0.01$		

ACDS, adenocarcinoma of distal stomach; ACOGC, adenocarcinoma of oesophagus and gastric cardia; CI, confidence interval; ICD, International Classification of Diseases Odds ratio when risk of the second category is defined as 1.0

**Table 2.39 Case-control studies of stomach cancer and alcoholic beverage consumption in China (published in the Chinese literature)**

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Exposure categories	Relative risk (95% CI)	Adjustment factors	Comments
Hu <i>et al.</i> (1989), Heilungjiang, Harbin, 1985–86	241; age and sex distribution not given; 100% histologically confirmed; response rate not given	Hospital patients from surgery department (non-cancer); matched to cases on age, sex, residence; response rate not given	Interviewer-administered questionnaire	Salty food intake + alcoholic beverage drinking Alcoholic beverage drinking + years of having chronic gastritis	<i>Odds ratios</i> 1.80 5.53	Hardness of food, average vegetable intake, smoking index, salty food intake, years of having chronic gastritis	95% CI not provided [ <i>p</i> -value <0.05]
Wu & Yao (1994), Shanshi, 1990	200 incident (178 men, 22 women), aged 30–79 years; 100% histologically confirmed; response rate not given	200 population; matched to cases on residence, sex, race, occupation, age	Interviewer-administered questionnaire	<i>Intake</i> >1 time/week	<i>Odds ratio</i> 2.87	Logistic models	

Table 2.39 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Exposure categories	Relative risk (95% CI)	Adjustment factors	Comments
Ye <i>et al.</i> (1998), Changle and Fuqing cities of Fujian Province, 1994–95	272 (233 men, 39 women), aged 30–78 years; lived in that area for more than 20 years; histologically or surgically confirmed; response rate not given	1:2 population; matched to cases by age, race, residence; not diagnosed with stomach diseases for past 3 years	Interviewer-administered questionnaire	Hard liquor Liquor Wine Beer	<i>Odds ratios</i> 1.41 (0.63–3.1) 1.12 (0.86–1.47) 1.09 (0.89–1.33) 1.33 (0.93–1.88)		
Qiu <i>et al.</i> (1999), Guangxi, 1992–97	319 hospitalized (226 men, 93 women), aged 18–76 years; 100% histologically confirmed; response rate not given	1:1 population, aged 17–78 years; matched to cases by sex, age, residence; not diagnosed with any malignancy; response rate not given	Interviewer-administered questionnaire	Alcohol drinking	<i>Odds ratio</i> 6.22 (3.08–10.92)	Multivariate logistic regression modeling	



**Table 2.39 (continued)**

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Exposure categories	Relative risk (95% CI)	Adjustment factors	Comments
Sun <i>et al.</i> (1999), Harbin, 1995–96	361 hospitalized (264 men, 97 women); aged 30–74 years; mean age: men (58.3), women (57.4); 100% histologically confirmed; response rate not given	1525 randomly selected healthy population; age similar to cases; mean age: men (48.5); women (48.6)	Interviewer-administered questionnaire	Intake No Yes	1.0 1.82 (1.37–2.41)	Age, sex, education, occupation, smoking	Odds ratio for smoking + drinking white wine + having chronic stomach diseases, 62.55 (18.44–212.18)
Sun <i>et al.</i> (2000), Harbin, 1996–99	201 (146 men, 55 women); mean age, 60.14 years; diagnosed by city hospitals; response rate not given	1818 (1560 men, 558 women) randomly selected from Harbin; mean age, 59.53 years; matched on sex, age; response rate not given	Interviewer-administered questionnaire	Alcohol drinking Smoking and drinking	1.29 (0.89–1.86) 2.34 (1.52–2.60)	Not listed	Categorization of each variable not listed

Table 2.39 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Exposure categories	Relative risk (95% CI)	Adjustment factors	Comments
Ding <i>et al.</i> (2001a,b) Taixing, Jiungsu, 1998–99	591 oesophageal cancer, 360 liver cancer, 430 stomach cancer (921 men, 460 women), aged 21–89 years; not histologically confirmed; response rate not given	1:1 population; matched on age, sex, residential area; response rate not given	Interviewer-administered questionnaire	Drinking white wine	<i>Odds ratio</i> 2.76	Results from multivariate logistic regression models	95% CIs not provided; categorization of variable not clear
Shen <i>et al.</i> (2001), Yangzhong, Jiangsu, 1997–98	265 with endoscopy and pathology diagnosis (117 from higher incidence area; 148 from lower incidence area); sex and age distribution not described, but percentage of men and mean age significantly higher in cases than in controls	2066 (850 from higher incidence area; 1216 from lower incidence area) selected from the spouse and siblings of cases or the sibling-in-law	Interviewer-administered questionnaire	Men ever drinking alcohol in higher incidence area Men ever drinking alcohol in lower incidence area	<i>Odds ratio</i> 3.6  3.7 (1.3–10.8)	Results from multivariate logistic regression model	CI not clear

Table 2.39 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Exposure categories	Relative risk (95% CI)	Adjustment factors	Comments
Tong <i>et al.</i> (2001), Tongliao, Inner Mongolia, 1999	76 oesophageal cancer (71 men, 5 women), aged 39–80 years; mean age, 58.5 years; 44 stomach cancer (35 men, 9 women), aged 35–78 years; mean age, 58.6 years; 100% histologically confirmed; response rate not given	1:3 hospital patients, aged 33–82 years; mean age, 58.2 years; matched on age, sex, residence area, time of diagnosis; response rate not given	Interviewer-administered questionnaire	Oesophagus and stomach combined Alcohol drinking (Yes/No)	<i>Odds ratio</i> 4.15 (1.71–15.92)	Results from multiple logistic regression model	

Table 2.39 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Exposure categories	Relative risk (95% CI)	Adjustment factors	Comments
Zheng <i>et al.</i> (2001), Fujian, 2000	251 (93 cardia, 85 non-cardia gastric cancer, 73 non-digestive tract cancer), aged 30–79 years; sex ratio (men/women), 6; lived in Fujian for more than 20 years; answered questions clearly; diagnosis confirmed by pathology, surgery, or endoscopy; response rate, 98.1%	97 hospital patients selected from orthopaedics and urinary departments, aged 30–79 years; lived in Fujian for more than 20 years; answered questions clearly; response rate, 98.1%	Interviewer-administered questionnaire	Hard liquor (Yes/No)	Cardia 3.25 (0.90–8.41) Non-cardia 2.08 (0.88–4.96)		
Chen <i>et al.</i> (2002b), Changle, Fujian, 1999	310, mean age, 60.8 years; sex ratio (male/female), 5; 95% histologically confirmed	1:1 selected from neighbours or colleagues of cases; matched to cases by age	Interviewer-administered questionnaire				No significant association between alcohol drinking and the use of refrigerator and the risk for stomach cancer.

Table 2.39 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Exposure categories	Relative risk (95% CI)	Adjustment factors	Comments
Gao <i>et al.</i> (2002a,b), Huaian, Jiangsu, 1997–2000	153 stomach cancer (118 men, 35 women); mean age, 61.1 years for men, 59.8 years for women; 141 oesophageal cancer (78 men, 63 women); mean age, 60.9 years for men, 60.7 years for women; 100% histologically confirmed; response rate not given	223 randomly selected population (149 men, 74 women); mean age, 58.9 years for men, 57.6 years for women; matched to cases on age; response rate not given	Questionnaire; blood samples	Alcohol drinking (frequently versus not)	1.76 (1.01–3.07)	Sex, age, vegetable intake, fruit intake, pickled vegetables, meat intake, soya product intake	Alcohol drinking increased the risk for stomach cancer among GSTM1 non-null people.

Table 2.39 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Exposure categories	Relative risk (95% CI)	Adjustment factors	Comments
Mu <i>et al.</i> (2003), Taixing, Jiangsu, 2000	206 stomach cancer, 204 liver cancer, 218 oesophageal cancer; sex ratio (male/female), 2 for stomach, 3.5 for liver, 2 for oesophageal cancer; aged >50 years, 88.1% for stomach cancer, 59.8% for liver cancer, 85.8% for oesophageal cancer	415 healthy population from Taixing; selected according to age and sex distributions of three case series; lived in Taixing for more than 10 years; sex ratio (male/female), 2.15; aged $\geq 50$ years, 75.8%	Interviewer-administered questionnaire; blood samples	<i>Green tea drinkers</i>		Age, sex, education level	
				Alcohol drinking			
				Not frequent	1.0		
				Frequent	0.44 (0.23–0.86)		
				<i>Green tea non-drinkers</i>			
				Alcohol drinking			
				Not frequent	1.0		
				Frequent	2.32 (1.23–4.38)		

Table 2.39 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Exposure categories	Relative risk (95% CI)	Adjustment factors	Comments
Fei & Xiao (2004), Shanghai	189 hospitalized, aged 29–91 years; mean age, 63.6 years; sex ratio (male/female), 1.4; 100% histologically confirmed; response rate not given	567 selected from the same hospital (medical check-up patients, non-digestive tract disease, non-cancer patients) as cases or from neighbours of cases; no difference between case and control groups on age, sex, ethnic group, residential area; response rate not given	Interviewer-administered questionnaire	Alcohol drinking (yes vs no)	<i>Odds ratio</i> 2.38 (1.48–3.82)		Univariate logistic regression analysis

Table 2.39 (continued)

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Exposure categories	Relative risk (95% CI)	Adjustment factors	Comments
Yang <i>et al.</i> (2004), Jintan, Huaian, Jiangsu, 1998–2003	285 (212 men, 73 women), aged 31–84 years; mean age, 61.4 years; % of histologically confirmed not given; response rate not given	265 (191 men, 74 women) aged 30–87 years; mean age, 61.5 years; selected and matched 1:1 to cases on residency, ethnic group, sex, age; residents with cancer and digestive tract diseases and those who did not answer questions clearly excluded; response rate not given	Questionnaire; blood sample	Alcohol drinking (yes/no)	<i>p</i> -value, 0.84	Crude analysis	



**Table 2.39 (continued)**

Reference, study location, period	Characteristics of cases	Characteristics of controls	Exposure assessment	Exposure categories	Relative risk (95% CI)	Adjustment factors	Comments
Luo (2005), Luoyang, Henan, 2003–2004	153 (117 men, 36 women), aged 38–74 years; lived in Luoyang for at least 15 years	153 healthy selected randomly from Luoyang; matched to cases on age, sex, ethnicity; lived in Luoyang for more than 15 years	Interviewer-administered questionnaire	Alcohol drinking (yes versus no)	2.14 (1.42–3.21)	Not described	Variables not well defined

CI, confidence interval; GSTM1, glutathione *S*-transferase M1

**Table 2.40 Selected cohort and case-control studies of cancer in subsites of the stomach and intake of alcoholic beverage**

Reference, study location, period	Alcoholic beverage consumption	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)
<b>Cohort studies</b>									
Sasazuki <i>et al.</i> (2002), Japan, Japan Public Health Cohort Study	0–3 times/month 0–161.0 g/week 162.0–322.0 g/week ≥322.5 g/week	<b>Cardia and upper third gastric</b>		<b>Distal gastric cancer</b>					
		<i>All histological types</i>		<i>Differentiated type</i>		<i>Undifferentiated type</i>			
		3	1.0	32	1.0	17	1.0		
		8	2.5 (0.7–9.5)	27	0.9 (0.5–1.5)	11	0.7 (0.3–1.4)		
		13	3.3 (0.9–11.6)	38	1.1 (0.7–1.8)	15	0.9 (0.5–1.9)		
		11	3.0 (0.8–11.1)	27	0.9 (0.5–1.5)	20	1.3 (0.7–2.6)		
			<i>p</i> =0.66		<i>p</i> =1.00		<i>p</i> =0.07		
Lindblad <i>et al.</i> (2005), United Kingdom, General Practitioner Research Database (nested case-control study)	Units/day 0–2 3–15 16–34 >34 Unknown use	<i>Gastric cardia</i>		<i>Non-cardia gastric</i>		<i>Unknown subsite of gastric adenocarcinoma</i>			
		<b>Odds ratio</b>		<b>Odds ratio</b>					
		55	1.00	124	1.00	172	1.00		
		33	1.08 (0.70–1.69)	61	0.99 (0.72–1.36)	72	0.82 (0.61–1.09)		
		14	1.22 (0.67–2.24)	19	0.91 (0.55–1.51)	25	0.79 (0.51–1.22)		
		4	1.04 (0.37–2.93)	2	0.29 (0.07–1.18)	10	0.96 (0.49–1.87)		
89	1.38 (0.84–2.26)	121	0.57 (0.38–0.87)	222	1.20 (0.89–1.62)				

Table 2.40 (continued)

Reference, study location, period	Alcoholic beverage consumption	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)
<b>Case-control studies</b>									
Jedrychowski <i>et al.</i> (1993), Poland, 1986-90	Average vodka per occasion	<b>Cardia</b>				<b>Non-cardia</b>			
		<i>Intestinalis</i>		<i>Diffusum</i>		<i>Intestinalis</i>		<i>Diffusum</i>	
	Non-drinker	6	1.0	6	1.0	26	1.0	20	1.0
	100 g	13	2.12 (0.69-6.50)	5	1.22 (0.28-5.35)	38	2.48 (1.28-4.82)	17	1.10 (0.48-2.50)
	250 g	36	2.28 (0.83-6.31)	9	1.16 (0.31-4.40)	77	2.06 (1.14-3.71)	57	1.70 (0.87-3.34)
	>250 g	24	3.04 (1.11-8.28)	8	1.64 (0.46-5.83)	58	2.47 (1.35-4.51)	44	1.81 (0.91-3.58)
		<i>p</i> =0.03		<i>p</i> =0.47					
Kabat <i>et al.</i> (1993), USA, 1981-90		<i>Distal oesophagus/cardia adenocarcinoma</i>				<i>Distal stomach adenocarcinoma</i>			
	<i>Men</i>	NR							
	Non-drinker			1.0				1.0	
	Occasional			2.0 (1.1-3.5)				1.0 (0.6-1.7)	
	1-3.9 oz WE/day			2.1 (1.2-3.6)				0.5 (0.3-0.9)	
	≥4 oz WE/day			2.3 (1.3-4.3)				0.7 (0.4-1.3)	
	<i>Women</i>	NR							
	Non-drinker			1.0				1.0	
	Occasional			0.6 (0.2-1.9)				0.6 (0.3-1.4)	
	1-3.9 oz WE/day			0.9 (0.2-3.5)				0.6 (0.2-1.8)	
≥4 oz WE/day			3.8 (0.9-16.6)				0.9 (0.3-3.1)		

Table 2.40 (continued)

Reference, study location, period	Alcoholic beverage consumption	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)
Inoue <i>et al.</i> (1994), Nagoya, Japan, 1988–91		<i>Cardia</i>		<i>Middle</i>		<i>Antrum</i>			
	Drinker (versus non-drinker)	NR	1.60 (0.92–2.78)	NR	1.47 (0.94–2.28)	NR	1.00 (0.69–1.46)		
	Current drinker		1.45 (0.82–2.57)		1.38 (0.88–2.16)		0.96 (0.65–1.41)		
	Former drinker		2.81 (1.21–6.54)		2.29 (1.12–4.68)		1.36 (0.69–2.70)		
	<1 year after quitting		3.71 (1.02–13.5)		3.63 (1.23–10.7)		2.16 (0.75–6.25)		
≥1 year after quitting		2.47 (0.93–6.59)		1.78 (0.75–4.23)		1.06 (0.46–2.45)			
Ji <i>et al.</i> (1996), Shanghai, China, 1988–89	<b>Men</b>	<i>Cardia</i>		<i>Distal</i>					
	<i>Ethanol (g/week)</i>								
	<175	8	0.55 (0.25–1.21)	51	1.14 (0.76–1.71)				
	175–349	14	0.75 (0.40–1.43)	54	1.08 (0.73–1.61)				
	350–524	23	1.37 (0.78–2.41)	57	1.07 (0.72–1.58)				
	≥525	16	0.81 (0.44–1.50)	80	1.36 (0.93–1.97)				
			<i>p</i> =0.93		<i>p</i> =0.17				
Non-drinker	80	1.0	272	1.0					
Former drinker	6	1.03 (0.40–2.67)	43	2.16 (1.27–3.69)					
Current drinker	57	0.86 (0.58–1.28)	218	1.11 (0.87–1.38)					

Table 2.40 (continued)

Reference, study location, period	Alcoholic beverage consumption	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)
Ji <i>et al.</i> (1996), (contd)	<i>Duration (years)</i>								
	<15	10	0.52 (0.26–1.06)	54	0.92 (0.63–1.34)				
	15–<24	27	1.19 (0.72–1.98)	89	1.23 (0.88–1.72)				
	≥35	26	0.88 (0.52–1.48)	115	1.40 (1.01–1.94)				
			<i>p</i> =0.88		<i>p</i> =0.03				
	<i>Lifetime ethanol (g/week × years)</i>								
	<2450	6	0.37 (0.15–0.88)	37	0.83 (0.54–1.28)				
	2450–7462	20	1.27 (0.71–2.26)	71	1.45 (1.00–2.11)				
	7463–15 399	18	1.01 (0.55–1.83)	46	0.83 (0.55–1.26)				
	≥15 400	17	0.84 (0.45–1.56)	88	1.55 (1.07–2.26)				
		<i>p</i> =0.91		<i>p</i> =0.06					
Zhang <i>et al.</i> (1996), USA, 1992–94	<i>Oesophagus and gastric cardia adenocarcinoma</i>								
	No	14	1.00	20	1.00	<i>Distal stomach adenocarcinoma</i>			
	≤1/week	26	3.02 (1.14–8.02)	20	1.60 (0.65–3.93)				
	>1/week	55	2.02 (0.85–4.82)	27	0.98 (0.43–2.27)				
		<i>p</i> =0.19		<i>p</i> =0.93					

Table 2.40 (continued)

Reference, study location, period	Alcoholic beverage consumption	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)
Gammon <i>et al.</i> (1997), USA, 1993–95	<i>Any</i>	<i>Gastric cardia adenocarcinoma</i>		<i>Other gastric adenocarcinoma</i>					
	Never	63	1.0	125	1.0				
	Ever	196	0.7 (0.5–1.1)	238	0.8 (0.6–1.1)				
	<5 drinks/week	46	0.6 (0.4–1.0)	74	0.7 (0.5–1.1)				
	5–11 drinks/week	59	0.8 (0.5–1.3)	68	0.9 (0.6–1.3)				
	12–30 drinks/week	52	0.7 (0.4–1.1)	55	0.7 (0.4–1.0)				
>30 drinks/week	39	0.7 (0.4–1.2)	41	0.6 (0.4–1.0)					
DeStefani <i>et al.</i> (1998a), Montevideo, Uruguay, 1992–96	<i>Total</i>	<i>Cardia</i>		<i>Fundus</i>		<i>Antrum</i>			
	1–60 g	8	1.0	7	1.0	49	1.0		
	61–120 g	6	0.6 (0.2–1.9)	7	1.1 (0.4–3.2)	78	1.5 (1.0–2.3)		
>120 g	10	1.0 (0.4–2.7)	11	1.8 (0.6–5.1)	113	2.6 (1.7–3.9)			
			<i>p</i> =0.93		<i>p</i> =0.25		<i>p</i> <0.001		
Ye <i>et al.</i> (1999), Sweden, 1989–95	<i>Total (mL 100% alcohol/month)</i>	<b>Cardia cancer</b> <i>All histological types</i>		<b>Distal stomach cancer</b> <i>Intestinal type</i>		<i>Diffuse type</i>			
	Non-drinker	18	1.0	52	1.0	36	1.0		
	1–35	20	0.9 (0.4–1.9)	64	1.2 (0.8–1.9)	50	1.3 (0.8–2.1)		
	36–160	27	0.8 (0.4–1.7)	73	1.2 (0.8–1.9)	42	1.0 (0.6–1.7)		
	>160	22	0.7 (0.3–1.5)	66	1.2 (0.7–1.9)	34	1.0 (0.5–1.8)		
			<i>p</i> =0.30		<i>p</i> =0.56		<i>p</i> =0.73		

Table 2.40 (continued)

Reference, study location, period	Alcoholic beverage consumption	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)
Lagergren <i>et al.</i> (2000), Sweden	Any	<i>Gastric cardia adenocarcinoma</i>							
	Never	34	1.0						
	Ever	228	0.8 (0.5–1.2)						
	<i>Ethanol (g)/week</i>								
	1–15	73	0.9 (0.5–1.5)						
	16–70	79	0.6 (0.4–1.1)						
	>70	76	0.9 (0.5–1.5)						
Zaridze <i>et al.</i> (2000), Moscow, Russia, 1996–97	<i>Vodka (L/year)</i>	<i>Cardia (men)</i>		<i>Other subsites (men)</i>					
	Never	4	1.0	24	1.0				
	Low <2.6	16	2.8 (0.9–9.2)	62	2.0 (1.0–3.8)				
	Medium 2.6–10.4	19	3.6 (1.1–11.8)	62	2.2 (1.1–4.1)				
	High >10.4	21	3.9 (1.2–12.3) <i>p</i> =0.03	40	1.3 (0.7–2.5) <i>p</i> =0.77				
Wu <i>et al.</i> (2001), Los Angeles, USA, 1992–97		<i>Gastric cardia adenocarcinoma</i>		<i>Distal gastric adenocarcinoma</i>					
	1–7 drinks/week	1.00 (0.7–1.5)		0.83 (0.6–1.2)					
	8–21 drinks/week	0.70 (0.4–1.1)		0.68 (0.5–1.0)					
	22–35 drinks/week	1.09 (0.7–1.8)		1.10 (0.7–1.7)					
	≥36 drinks/week	1.35 (0.8–2.3)		1.35 (0.8–2.2)					
		<i>p</i> =0.42		<i>p</i> =0.29					

Table 2.40 (continued)

Reference, study location, period	Alcoholic beverage consumption	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)
Kikuchi <i>et al.</i> (2002), Tokyo, Japan, 1993–95	<b>Men</b>	NR	Proximal	Distal	0	2.72 (1.13–6.53)	1.28 (0.60–2.76)		
					0.1–134.9	1.0	1.0		
					135–1349.9	2.24 (1.01–4.96)	1.85 (1.00–3.41)		
					≥1350	2.46 (1.17–5.17)	1.56 (0.86–2.84)		
	<b>Women</b>	NR	Proximal	Distal	0 (never drinker)	1.50 (0.70–3.21)	1.69 (0.85–3.35)		
					0.1–134.9	1.0	1.0		
					≥135.0	0.43 (0.10–2.05)	1.78 (0.67–4.71)		
						<i>p</i> =0.06	<i>p</i> =0.25		

CI, confidence interval; NR, not reported



cancer. In two studies of histological types, the intestinal type seemed to be more strongly associated with alcoholic beverage consumption (Jedrychowski *et al.*, 1993).

(a) *Gastric cardia cancer*

Prospective cohort studies have reported an association between alcoholic beverage consumption and the risk for adenocarcinoma of the gastric cardia and distal stomach (Sasazuki *et al.*, 2002; Lindblad *et al.*, 2005; Tran *et al.*, 2005). Sasazuki *et al.* (2002) reported an elevated risk for cardia cancer of all histological types with alcoholic beverage consumption, although the relationship failed to reach significance. Tran *et al.* (2005) reported inverse associations for cardia and non-cardia cancer with alcoholic beverage consumption. The relative risks were 0.84 (95% CI, 0.72–0.97) for cardia cancer and 0.79 (95% CI, 0.61–1.02) for non-cardia cancer.

Among 12 case–control studies that reported an association between alcoholic beverage consumption and cardia cancer, five studies reported a statistically significant association (Jedrychowski *et al.*, 1993; Kabat *et al.*, 1993; Inoue *et al.*, 1994; Zaridze *et al.*, 2000; Kikuchi *et al.*, 2002). The adjusted odds ratios were between 2.3 and 3.9 for heavy drinkers and a strong dose–response relationship was demonstrated in four of the five studies.

Zaridze *et al.* (2000) reported that the effect of hard liquor (vodka) consumption was stronger for cancer of the cardia in men. Compared with non-drinkers, the adjusted odds ratios in men were 2.8 (95% CI, 0.9–9.2) for light drinkers, 3.6 (95% CI, 1.1–11.8) for medium drinkers and 3.9 (95% CI, 1.2–10.2) for heavy drinkers.

An elevated risk for cardia cancer was observed among heavy drinkers in two case–control studies, but the results were not statistically significant (Zhang *et al.*, 1996; Wu *et al.*, 2001). Five studies observed no association between alcoholic beverage consumption and cardia cancer (Ji *et al.*, 1996; Gammon *et al.*, 1997; De Stefani *et al.*, 1998a; Ye *et al.*, 1999; Lagergren *et al.*, 2000). In a population-based case–control study of 90 cases of gastric cardia cancer, 260 and 164 cases of intestinal and diffuse types of distal gastric cancer, respectively, results from Ye *et al.*, (1999) showed that intake of alcoholic beverages was not associated with an increased risk for any type of cardia or gastric cancer. In a case–control study in Shanghai, China, Ji *et al.* (1996) examined the role of alcoholic beverage drinking as a risk factor for carcinoma by anatomic subsite of the stomach. Alcoholic beverage consumption was associated with a moderately excess risk for distal stomach cancer (odds ratio, 1.55; 95% CI, 1.07–2.26), but was not related to the risk for cardia cancer.

(b) *Distal stomach cancer*

Among 11 studies of distal stomach cancer, six observed a positive association (Jedrychowski *et al.*, 1993; Inoue *et al.*, 1994; Ji *et al.*, 1996; De Stefani *et al.*, 1998a; Zaridze *et al.*, 2000; Kikuchi *et al.*, 2002). The relationship was not as strong as that for cardia cancer, but the dose–response relationship was just as clear.

#### 2.7.4 *Type of alcoholic beverage (Table 2.41)*

Some investigators considered the role of different types of alcoholic beverage and reported that the consumption of beer, spirits or wine did not affect the incidence of stomach cancer (Hansson *et al.*, 1994; Zhang *et al.*, 1996; Ye *et al.*, 1999; Wu *et al.*, 2001). In northern Italy, where wine was the most frequently consumed alcoholic beverage and accounted for approximately 90% of all alcoholic beverage consumption in the population, D'Avanzo *et al.* (1994) reported that the risk estimates adjusted for age and sex were 1.1 for light-to-moderate wine drinkers, 1.3 for intermediate drinkers, 1.6 for heavy drinkers and 1.4 for very heavy drinkers ( $\geq 8$  drinks per day). López-Carrillo *et al.* (1998) reported an assessment of alcoholic beverage consumption in Mexico, including the popular Mexican liquor tequila, in relation to the incidence of stomach cancer. After adjustment for known risk factors, wine consumption was positively associated with the risk for developing stomach cancer (odds ratio, 2.93; 95% CI, 1.27–6.75) in the highest category of wine consumption, which corresponded to at least 10 glasses of wine per month, with a significant trend ( $P=0.005$ ).

In a multicentric hospital-based case–control study carried out in Poland, the relative risk for stomach cancer increased as the frequency and amount of vodka drunk increased. People who drank vodka at least once a week had an threefold higher risk compared with non-drinkers (relative risk, 3.06; 95% CI, 1.90–4.95) (Jedrychowski *et al.*, 1993). Alcoholic beverage consumption, particularly that of vodka, was found to increase the risk for gastric cancer in a Russian study (Zaridze *et al.*, 2000). A case–control study that included 331 cases and 622 controls conducted in Montevideo, Uruguay, found that alcoholic beverage consumption (particularly that of hard liquor and beer) was associated with an odds ratio of 2.4 (95% CI, 1.5–3.9), after controlling for the effect of tobacco, vegetables and other types of beverage (De Stefani *et al.*, 1998a). In another multicentric, hospital-based case–control study conducted in Germany, increased consumption of beer showed a positive association with risk whereas increased consumption of wine and liquor showed a significantly negative association (Boeing *et al.*, 1991).

#### 2.7.5 *Effect modification (Table 2.42)*

Several studies reported on the joint effects of alcoholic beverage consumption and tobacco smoking (Kabat *et al.*, 1993; Hansson *et al.*, 1994; Inoue *et al.*, 1994; Ji *et al.*, 1996; De Stefani *et al.*, 1998a; Zaridze *et al.*, 2000). The results of a case–control study in Nagoya, Japan, showed that the joint effect of drinking and smoking may play an important role in the development of stomach cancer, especially that of cardia cancer (odds ratio, 4.7; 95% CI, 1.1–20.2) (Inoue *et al.*, 1994). However, most studies did not evaluate potential effect modification between alcoholic beverage consumption and tobacco smoking.

**Table 2.41 Selected cohort and case-control studies of stomach cancer and different types of alcoholic beverage**

Reference, location, period	Cohort/cases and controls	Beer			Wine			Hard liquor		
		Exposure	Cases	Relative risk (95% CI)	Exposure	Cases	Relative risk (95% CI)	Exposure	Cases	Relative risk (95% CI)
<b>Cohort study</b>										
Nomura <i>et al.</i> (1990), USA, Hawaii, American Men of Japanese Ancestry Study	7990 American men of Japanese ancestry, born on the Hawaiian island of Oahu; follow-up, 19 years	Non-drinker	64	1.0	Non-drinker	124	1.0	Non-drinker	86	1.0
		<10 oz/month	10	0.7 (0.4–1.4)	1 oz/month	13	1.1 (0.6–1.9)	<5 oz/month	29	0.9 (0.6–1.4)
		10–99 oz/month	17	1.2 (0.7–2.1)	≥2 oz/month	11	0.7 (0.4–1.3)	5–49 oz/month	26	1.5 (1.0–2.2)
		100–499 oz/month	28	1.1 (0.7–1.8)				≥50 oz/month	8	1.0 (0.5–2.1)
		≥500 oz/month	28	1.1 (0.7–1.7)						
<b>Case-control studies</b>										
D'Avanzo <i>et al.</i> (1994), Milan, Italy, 1985–93	746 cases of histologically confirmed stomach cancer; 2053 hospital controls	Non-drinker	672	1.0	Non-drinker	197	1.0	Non-drinker	650	1.0
		< 1 drink/day	35	0.9 (0.6–1.4)	<2 drinks/day	108	1.1 (0.8–1.4)	<1 drink/day	45	0.7 (0.5–0.9)
		1–2 drinks/day	15	1.6 (0.9–3.1)	2–<4 drinks/day	201	1.1 (0.9–1.4)	1–<2 drinks/day	31	1.0 (0.7–1.6)
		≥ 2 drinks/day	24	1.1 (0.7–1.9)	4–6 drinks/day	121	1.3 (1.0–1.7)	≥2 drinks/day	20	0.9 (0.5–1.5)
					6–<8 drinks/day	56	1.6 (1.1–2.4)			
					≥8 drinks/day	63	1.4 (1.0–2.0)			

Table 2.41 (continued)

Reference, location, period	Cohort/cases and controls	Beer			Wine			Hard liquor		
		Exposure	Cases	Relative risk (95% CI)	Exposure	Cases	Relative risk (95% CI)	Exposure	Cases	Relative risk (95% CI)
Hansson <i>et al.</i> (1994), Sweden, 1989–92	338 histologically confirmed cases of gastric cancer; 679 controls	Non-drinker	278	1.0	Non-drinker	154	1.0	Non-drinker	123	1.0
		Drinkers	60	0.95 (0.68–1.37)	1–59 mL/month	86	1.35 (0.97–1.88)	1–79 mL/month	98	1.23 (0.87–1.76)
					60–199 mL/month	31	0.70 (0.44–1.13)	80–319 mL/month	57	0.91 (0.61–1.38)
					200–599 mL/month	51	0.21 (0.80–1.83)	≥320 mL/month	60	1.27 (0.83–1.96)
					≥600 mL/month	16	0.57 (0.31–1.04)			<i>p</i> =0.61
Zhang <i>et al.</i> (1996), USA, 1992–94	95 adenocarcinomas of oesophagus and gastric cardia, 67 adenocarcinomas of the distal stomach; 132 cancer-free controls	No	20	1.00	No	20	1.00	No	20	1.00
		≤1/week	17	1.13 (0.46–2.76)	≤1/week	21	1.21 (0.51–2.83)	≤1/week	19	1.91 (0.76–4.79)
		>1/week	11	1.43 (0.45–4.58)	>1/week	12	0.97 (0.36–2.58)	>1/week	12	0.66 (0.22–1.99)
				<i>p</i> =0.55			<i>p</i> =0.99			<i>p</i> =0.73
Gammon <i>et al.</i> (1997), USA, 1993–95	368 gastric adenocarcinoma and 695 other gastric	Never	200	1.0	Never	258	1.0	Never	188	1.0
		Ever	166	0.8 (0.6–1.1)	Ever	108	0.7 (0.5–0.9)	Ever	177	1.0 (0.8–1.4)

Table 2.41 (continued)

Reference, location, period	Cohort/cases and controls	Beer			Wine			Hard liquor		
		Exposure	Cases	Relative risk (95% CI)	Exposure	Cases	Relative risk (95% CI)	Exposure	Cases	Relative risk (95% CI)
DeStefani <i>et al.</i> (1998a), Montevideo, Uruguay, 1992–96	331 cases; 622 controls (men only)	Non-drinker	265	1.0	Non-drinker	97	1.0	Non-drinker	166	1.0
		1–60 g/day	18	1.1 (0.6–2.1)	1–60 g/day	106	1.1 (0.7–1.5)	1–60 g/day	62	1.0 (0.7–1.5)
		61–120 g/day	20	1.9 (0.9–3.7)	61–120 g/day	72	1.4 (0.9–2.2)	61–120 g/day	30	1.7 (0.9–2.9)
		>120 g/day	0	–	>120 g/day	36	0.9 (0.4–1.8)	>120 g/day	53	2.1 (1.1–3.9)
						$p=0.06$				
							$p=0.47$			$p=0.01$
López-Carrillo <i>et al.</i> (1998), Mexico	220 newly diagnosed adenocarcinoma of the stomach; 757 population-based controls	Non-beer consumer	105	1.0	Non-wine consumer	133	1.0	Non-liquor consumer	114	1.0
		<1 drink/day	60	1.06 (0.64–1.73)	<1 drink	54	2.08 (1.26–3.44)	<1 drink/day	17	0.78 (0.38–1.61)
		≥1 drink/day	54	1.04 (0.55–1.94)	≥1 drink	32	2.93 (1.27–6.75)	≥1 drink/day	89	1.83 (1.07–3.10)
						$p=0.005$			$p=0.175$	
						$p=0.115$				
Ye <i>et al.</i> (1999), Sweden, 1989–95	90 gastric cardia, 260 and 164 distal gastric cancer of intestinal and diffuse types; 1164 frequency-matched controls	Light beer	118	1.0	Non-drinker	65	1.0	Non-drinker	58	1.0
		<400 mL/month	24	0.9 (0.5–1.4)	1–59 mL/month	43	1.6 (1.0–2.6)	1–79 mL/month	41	0.9 (0.5–1.5)
		400–2399 mL/month	24	0.9 (0.5–1.4)	60–199 mL/month	15	0.6 (0.3–1.2)	80–319 mL/month	32	0.8 (0.5–1.5)
		≥2400 mL/month	22	0.9 (0.5–1.5)	200–599 mL/month	25	1.3 (0.7–2.4)	≥320 mL/month	32	1.4 (0.7–2.8)
				$p=0.60$	≥600 mL/month	15	1.1 (0.6–2.3)			$p=0.42$
						$p=0.90$				

**Table 2.41 (continued)**

Reference, location, period	Cohort/cases and controls	Beer			Wine			Hard liquor		
		Exposure	Cases	Relative risk (95% CI)	Exposure	Cases	Relative risk (95% CI)	Exposure	Cases	Relative risk (95% CI)
Wu <i>et al.</i> (2001), Los Angeles; USA, 1992–97	277 cardia, 443 non-cardia; 1356 controls	None		1.0	None		1.0	None		1.0
		<7 drinks/week		0.90 (0.7–1.3)	<7 drinks/week		0.90 (0.7–1.2)	<7 drinks/week		0.63 (0.5–0.9)
		7–14 drinks/week		1.01 (0.7–1.6)	7–14 drinks/week		0.77 (0.5–1.3)	7–14 drinks/week		0.61 (0.4–1.0)
		≥15 drinks/week		1.67 (1.1–2.6)	≥15 drinks/week		0.44 (0.2–1.2)	≥15 drinks/week		0.70 (0.4–1.1)
				<i>p</i> =0.09			<i>p</i> =0.04			<i>p</i> =0.02

CI, confidence interval

**Table 2.42 Cohort and case-control studies of stomach cancer and alcoholic beverage consumption in men and women**

Study reference	Description	Drinking level	Men		Women	
			No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)
<b>Cohort study</b>						
Kato <i>et al.</i> (1992a), Japan	9753	None	8	1.00	18	1.00
	Japanese men and women; age: men, ≥ 40 years; women, ≥ 30 years; response rate, 85.9%; follow-up 1986–91	Occasional	9	2.31 (0.88–6.07)	3	1.12 (0.32–3.90)
		Daily <50mL	6	1.31 (0.45–3.81)	1	1.29 (0.17–9.69)
		Daily ≥50 mL	12	3.63 (1.44–9.11)		
<b>Case-control studies</b>						
Kabat <i>et al.</i> (1993), USA, 1981–90	152 (122 men, 31 women) cases; 4162 men, 2222 women controls; matched by age, sex, race, hospital	Non-drinker		1.0		1.0
		Occasional		1.0 (0.6–1.7)		0.6 (0.3–1.4)
		1–3.9 oz/day		0.5 (0.3–0.9)		0.6 (0.2–1.8)
		≥4 oz/day		0.7 (0.4–1.3)		0.9 (0.3–3.1)

Table 2.42 (continued)

Study reference	Description	Drinking level	Men		Women	
			No. of cases	Relative risk (95% CI)	No. of cases	Relative risk (95% CI)
Zaridze <i>et al.</i> (2000), Moscow, Russia, 1996–97	489 (248 men, 200 women), histologically confirmed; 610 (292 men, 318 women) hospital-based controls	<i>Vodka (L/year)</i>				
		Never	28	1.0	95	1.0
		Low <2.6	78	2.0 (1.1–3.7)	62	1.5 (1.0–2.4)
		Medium 2.6–10.4	81	2.3 (1.3–4.2)		
		High >10.4	61	1.7 (0.9–3.1) <i>p</i> =0.20	45	1.3 (0.8–2.2) <i>p</i> =0.17

CI, confidence interval



When stratified by gender, the results for men were statistically significant while those for women showed similar point estimates but insignificant trends. Kato *et al.* (1992a) examined the risk for men and women separately in a clinical epidemiological study and observed an increased risk for stomach cancer in daily consumers of alcoholic beverages compared with non-drinkers, but this association was not statistically significant. In a case–control study conducted in Japan, light drinkers showed the lowest risk among both men and women, and heavy drinkers showed the highest risk among men. In other words, the association was J-shaped among men and U-shaped among women (Kikuchi *et al.*, 2002).