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Alcohol intake and death from cancer in a prospective Chinese elderly cohort study in Hong Kong

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ABSTRACT

Background In observational studies of Western populations, moderate alcohol use is usually associated with lower cancer mortality rates. However, moderate alcohol use (regular drinking of moderate amounts) is socially patterned. Evidence from other contexts can clarify such observations. We examined the association of moderate alcohol use with death from cancer in older Chinese adults from a developed non-Western setting, where occasional alcohol drinking (less than once per week of small amounts) is typical.

Methods Multivariable Cox regression analysis was used to assess the adjusted associations of alcohol use with death from cancer using a population-based prospective cohort of 66 820 Chinese aged ≥65 years enrolled from July 1998 to December 2001 at all the 18 Elderly Health Centres of the Hong Kong Government Department of Health, and followed till 30 May 2012.

Results After follow-up for about 10.5 years, 6335 cancer deaths were identified. Most current alcohol users were social drinkers (<1/week). Moderate drinkers had a similar risk of death from non-oesophageal cancer as never drinkers, but a higher risk of oesophageal cancer, adjusted for age, sex, socioeconomic position, lifestyle and health status. Social drinking (<1/week) was associated with a lower risk of death from non-oesophageal cancer, but not from oesophageal cancer.

Conclusions In a non-Western setting, no association of moderate alcohol use with death from cancer was found. Occasional social drinking (<1/week) was associated with a lower risk of cancer, suggesting that moderate alcohol use is not protective, but in any setting the attributes of being a typical drinker may be.

INTRODUCTION

Alcohol is classified as a carcinogen.[1] In contrast, some epidemiological studies in Western countries have observed low-to-moderate drinking (regular drinking of <36 g alcohol/day) to be associated with a lower risk of death from cancer.[2–4] However, conventional observational studies are inevitably open to biases from residual confounding, reverse causality and overadjustment due to an imperfect understanding of the underlying biological pathways. In Western settings, moderate alcohol use, rather than lifelong abstention, is associated with many positive health attributes.[5–8] In addition, drinking patterns may change with ageing and ill health,[9] such that with increasing age moderate alcohol users are increasingly heavily self-selected healthy users. In these situations, particularly when randomised controlled trials are not feasible or ethical, reassessing the same question in a different social context with a different drinking pattern and confounding structure can help distinguish whether such observations from Western settings are biologically based or contextually specific.

Southern Chinese have a different drinking pattern from Western populations. The typical drinking pattern in Southern China is occasional alcohol use on a few special occasions per year,[10 11] which we have previously exploited to clarify the association of moderate alcohol use with cardiovascular disease risk factors and cognitive function.[12 13] Few studies have examined the association of moderate alcohol use with cancer in such populations, and they have not always made the key distinction between moderate alcohol users drinking on a regular basis, which would be expected to have a biological effect, and occasional alcohol users only drinking a few times a year,[14] which would be less likely to have a biological effect. To clarify the association of moderate alcohol use with all-cause and cause-specific cancers, distinguishing moderate alcohol users from occasional alcohol users, we examined these associations in a large cohort of older Southern Chinese from Hong Kong.

METHODS

Source of data

Since July 1998, 18 Elderly Health Centres have been established in Hong Kong to offer older people screening services and medical examinations, aiming to provide an enhancement to primary healthcare, improving self-care ability, encouraging a healthy lifestyle and strengthening family and care support so as to minimise illness and disability. Residents of Hong Kong aged 65 years or older were encouraged to enrol with a low membership fee. All those enrolled from July 1998 to December 2001 were included in this prospective cohort study. In this cohort, age, socioeconomic position, current smoking status and hospital use were similar to the general elderly population, although more women enrolled than men.[15]

Alcohol use

Alcohol use status was assessed during the baseline interview when participants were asked their type of drinking (never, social, regular or ex-drinking), the number of days per week they drank, and for regular drinkers the amount drunk per occasion. Social drinkers are a specific type of drinker in this region. They do not usually drink alcohol every

day, but only drink occasionally on special occasions such as family gatherings or weddings. Based on this information, participants were categorised as never, social (<1/week), weekly social, moderate, high and ex-drinkers, as previously,[16] and consistent with other similar studies.[13 16–18] Moderate drinkers were defined as people who reported regular drinking of three or fewer units per day for men and two or fewer units per day for women where one unit was defined as 10 g ethanol. High drinkers were defined as people who reported regular drinking of more than these amounts. We used alcohol in categories, because in the initial analysis (excluding ex-drinkers) models for all cancer and non-oesophageal cancer fitted better (had a lower Akaike Information Criterion) using alcohol in categories than as a continuous quantity (data not shown).

Health status

In accordance with other prognostic indices, a simple but comprehensive 11-item index was formed by counting chronic conditions (five items: heart disease; stroke, diabetes, chronic obstructive pulmonary disease and/or asthma, and hypertension (reported or measured blood pressure ≥140/90 mm Hg)), use of health services (two items: regular use of medication and any hospital admission in the last year), frailty (three items: cognitive impairment (abbreviated mental test score <8), functional impairment (activities of daily living (ADL)/instrumental ADL score >12) and two or more falls in the last 6 months) and unintentional weight loss of more than 4.5 kg in the last 6 months (one item) was constructed.[19] Health status was categorised according to this morbidity index as good (0, 1 or 2 items) or poor (three or more items).

Follow-up

Participants were followed from July 1998 until death or 30 May 2012, whichever came first. Vital status and causes of death were identified from death registration, special outpatient and hospitalisation databases in Hong Kong via record linkage using their unique Hong Kong identity card number.[20] Causes of death were routinely coded by International Classification of Disease (ICD) 9th Reversion before 2001 and 10th Reversion after 2001 by the physicians attending the decedent. Most Hong Kong residents die in hospital, ensuring a high quality cause of death classification. Vital status not ascertained from record linkage was obtained by telephone interview. Those whose vital status could not be ascertained were assumed to be alive.

Outcomes

The primary outcome was death from non-oesophageal cancer (ICD-9 145–149, 151–238 and ICD-10 C00–C14, C16–C97, D00–D48). Oesophageal cancer (ICD-9 150 or ICD-10 C15) was a 'validation outcome' because alcohol use causes oesophageal cancer. The secondary outcomes were other potentially alcohol-related cancers: head and neck (ICD-9 141–149 or ICD-10 C07–C14, C32–C33), lung (ICD-9 162 or ICD-10 C33–C34), liver (ICD-9 155 or ICD-10 C22), stomach (ICD-9 151 or ICD-10 C16), colorectal (ICD9 153–154 or ICD10 C18–C21), prostate (ICD9 185 or ICD10 C61), breast (ICD9 174–175 or ICD10 C50), pancreatic (ICD9 157 or ICD10 C25) and leukaemia (ICD-9 208 or ICD-10 C91–C95).

Statistical analysis

χ^2 Tests were used to compare proportions of participants by alcohol use group. Multivariable Cox regression was used to estimate HRs with 95% CIs of death from cancer. Models were built in stages. Model 1: adjusted for age and sex. Model 2: additionally adjusted for education, housing type, monthly expenditure, body mass index (BMI), exercise and health status. Model 3: additionally adjusted for smoking, and the interaction of smoking and sex and smoking and age group. All confounders were classified as in table 1. Whether associations varied by sex, age or smoking status was assessed from the significance of the interaction terms and the heterogeneity of estimates across strata. The proportional hazards assumption was checked by visual inspection of plots of log (–log S) against time. Two sensitivity analyses were performed: first, excluding participants with self-reported cancer at baseline; and second, excluding cancer deaths within the first 3 years of study entry.

RESULTS

This cohort study included 66 820 participants, 22 680 men and 44 140 women, of whom 5 did not report alcohol use. After an average of 10.5 years follow-up, 62 824 had vital status ascertained from record linkage including 19 452 deaths, 2539 had vital status obtained by telephone interview including 393 deaths and 1457 had vital status which could not be ascertained and were presumed to be alive. There were 6335 deaths from cancer, including 115 deaths from oesophageal cancer. In this Chinese setting, few participants were moderate drinkers (3%). Most participants were never drinkers (72%) or social drinkers (<1/week; 13%). Table 1 shows that both moderate drinkers and social drinkers (<1/week) were younger and better educated than never drinkers, but they were also more likely to be smokers. Moderate drinkers also had lower BMI and better health status. Ex-drinkers had the worst health.

Table 2 shows that moderate alcohol use was associated with a non-significantly higher risk of death from all cancer excluding oesophageal adjusted for age, sex, socioeconomic position, BMI, exercise and health status (model 2). However, after adjustment for smoking, and the interaction of smoking and sex and of smoking and age groups (model 3), the estimate was close to the null. In contrast, social drinking was only associated with a lower risk of cancer in model 3. As expected, high alcohol use was associated with death from cancer. Alcohol use had a clear dose–response with oesophageal cancer in all models. The association of alcohol use with death from non-oesophageal or oesophageal cancer did not vary with age (p values for interaction 0.67 and 0.99), sex (0.64 and 0.67) or smoking status (0.33 and 0.97).

Table 3 shows the association of alcohol use with site-specific cancers adjusted for age, sex, socioeconomic position, smoking status, BMI, exercise, health status and the interaction of the smoking and sex and smoking and age groups. Moderate alcohol use was not associated with any cancer considered. Social drinkers (<1/week) had a lower risk of death from lung cancer. High drinking was associated with a higher risk of death from head and neck cancer and lung cancer. Ex-drinking was associated with higher risk of death from pancreatic cancer.

For completeness, table 4 shows sex-specific associations. The associations of moderate and social (<1/week) drinking with death from the cancers considered were generally similar for men and women. We also assessed smoking-specific associations. Moderate drinking was similarly not associated with death from non-oesophageal cancer for current smokers (HR=1.00, 95% CI 0.81 to 1.24), ex-smokers (HR=0.92, 95% CI 0.74 to 1.15) and never-smokers (HR=0.92, 95% CI 0.70 to 1.21). Occasional social drinking also had similar associations with non-oesophageal cancer for current smokers (HR=0.81, 95%

Table 1 Baseline characteristics by alcohol use group of participants at Elderly Health Centres in Hong Kong from 1998 to 2001

	Alcohol use status for men (n=22 677)							Alcohol use status for women (n=44 138)						
	Never (n=11 069)	Social (<1/week) (n=4723)	Weekly social (n=596)	Moderate (n=1732)	High (n=462)	Ex-drinker (n=4095)	p Value*	Never (n=37 277)	Social (<1/week) (n=3654)	Weekly social (n=298)	Moderate (n=375)	High (n=64)	Ex-drinker (n=2470)	p Value*
Age group (%)														
65–69	38.7	46.0	47.7	42.8	45.7	31.2		40.5	48.2	53.0	39.7	45.3	33.3	
70–74	31.3	31.7	31.4	33.5	34.9	33.3		29.7	28.9	24.5	31.5	32.8	31.5	
75–79	18.9	15.3	13.9	16.6	13.0	21.5		18.2	15.3	13.8	19.7	14.1	20.5	
80–84	8.0	5.5	6.4	5.5	5.0	10.2		8.0	5.6	7.4	6.7	3.1	9.6	
≥85	3.1	1.6	0.7	1.6	1.5	3.7	<0.001	3.6	1.9	1.3	2.4	4.7	5.1	<0.001
Education (%)														
Postsecondary``	8.6	7.2	7.2	5.4	3.7	4.3		1.9	2.5	0.7	2.4	0.0	1.3	
Secondary	25.7	25.7	20.3	21.4	17.5	17.9		8.4	9.0	3.7	8.5	6.3	4.7	
Primary	49.3	52.0	51.0	52.9	53.7	55.0		29.4	31.4	27.5	26.1	28.1	25.0	
No formal but literate	9.8	9.4	12.1	11.4	14.7	13.2		20.0	21.9	18.5	18.4	26.6	24.0	
Illiterate	6.6	5.7	9.4	8.9	10.4	9.7	<0.001	40.4	35.2	49.7	44.5	39.1	45.0	<0.001
Housing (%)														
Public and aided	37.5	39.5	38.8	41.9	46.1	43.1		39.8	41.8	38.3	42.4	42.2	40.8	
Private (rent)	5.9	4.7	5.2	4.4	4.8	5.6		4.7	4.3	9.1	6.4	3.1	5.2	
Private (self-owned)	50.8	52.3	52.4	49.0	44.4	44.1		48.1	49.8	49.7	45.9	51.6	45.2	
Temporary	0.8	0.5	0.5	1.4	1.5	1.1		0.9	0.7	0.0	1.9	0.0	1.3	
Institutions	3.0	1.2	1.7	1.8	1.7	4.5		4.6	1.8	1.7	1.3	1.6	6.6	
Others	2.1	1.8	1.5	1.5	1.5	1.7	<0.001	2.0	1.5	1.3	2.1	1.6	0.9	<0.001
Monthly expenditure (HK$) (%)														
<1000	11.7	12.0	8.6	9.8	8.2	12.3		16.8	14.2	10.7	16.8	14.1	16.6	
1000–1999	35.6	35.8	36.6	37.4	28.4	37.2		39.4	40.1	38.6	40.0	31.3	38.0	
2000–2999	31.4	31.8	32.4	33.3	37.2	32.5		29.7	30.0	35.9	27.5	23.4	30.2	
3000–5999	18.0	17.3	18.6	16.8	22.3	15.6		12.7	14.0	14.1	14.4	29.7	14.1	
6000–9999	2.4	2.2	2.7	2.1	3.0	1.7		1.1	1.4	0.7	0.8	1.6	0.9	
>10 000	1.0	0.9	1.2	0.5	0.9	0.6	<0.001	0.3	0.4	0.0	0.5	0.0	0.3	<0.001
Body mass index (%)														
<18.5	6.2	4.1	5.4	5.7	5.6	7.0		5.1	4.3	4.7	7.7	9.4	5.0	
18.5 to <23	33.9	32.4	31.5	35.4	43.5	31.8		31.0	30.4	28.5	32.5	26.6	29.7	
23 to <25	24.1	24.5	22.8	24.0	23.4	24.3		21.7	22.1	20.1	18.4	21.9	21.1	
25 to <30	32.2	34.9	35.6	32.0	23.4	32.4		34.6	35.6	37.3	36.3	39.1	35.5	
≥30	3.7	4.1	4.7	2.9	4.1	4.5	<0.001	7.6	7.6	9.4	5.1	3.1	8.7	<0.001
Exercise (%)														
Never	16.3	16.7	14.4	18.7	28.1	15.8		14.5	16.3	15.4	18.4	21.9	14.9	
<30 min/day	24.3	24.3	18.6	24.8	24.5	26.8		27.9	27.6	21.5	26.7	23.4	29.8	
≥30 min/day	59.4	59.0	67.0	56.5	47.4	57.4	<0.001	57.6	56.0	63.1	54.9	54.7	55.2	<0.001
Health status (%)														
Good	62.4	74.8	83.4	79.1	77.3	52.1		60.9	79.7	87.2	80.5	78.1	52.2	
Poor	37.6	25.2	16.6	20.9	22.7	47.9	<0.001	39.1	20.3	12.8	19.5	21.9	47.8	<0.001

Continued

Table 1 Continued

	Alcohol use status for men (n=22 677)							Alcohol use status for women (n=44 138)						
	Never (n=11 069)	Social (<1/week) (n=4723)	Weekly social (n=596)	Moderate (n=1732)	High (n=462)	Ex-drinker (n=4095)	p Value*	Never (n=37 277)	Social (<1/week) (n=3654)	Weekly social (n=298)	Moderate (n=375)	High (n=64)	Ex-drinker (n=2470)	p Value*
Smoking status (%)														
Never	52.2	31.7	25.0	25.8	12.8	16.7		90.9	79.5	77.5	69.1	64.1	65.9	
Current	16.9	21.4	25.2	32.7	53.7	19.5		3.3	7.8	11.4	16.3	20.3	5.8	
Ex-smoker	30.9	46.9	49.8	41.6	33.6	63.9	<0.001	5.8	12.7	11.1	14.7	15.6	28.3	<0.001

*Two-sided p value from a χ^2 test.

CI 0.68 to 0.96), ex-smokers (HR=0.85, 95% CI 0.73 to 0.98) and never-smokers (HR=0.94, 95% CI 0.84 to 1.06).

After excluding participants with self-reported cancer at baseline (n=446) or excluding all cancer deaths within 3 years of the study entry (n=1386), the estimates were similar. Moderate drinking remained associated with death from oesophageal cancer (HR=3.14, 95% CI 1.62 to 6.08 and HR=2.60, 95% CI 1.20 to 5.65, respectively), but not with non-oesophageal cancer (HR=0.97, 95% CI 0.85 to 1.11 and HR=0.97, 95% CI 0.84 to 1.12). Social drinking (<1/week) still had no association with death from oesophageal cancer (HR=1.34, 95% CI 0.75 to 2.39 and HR=1.32, 95% CI 0.70 to 2.49) and remained associated with a lower risk of death from non-oesophageal cancer (HR=0.88, 95% CI 0.81 to 0.95 and HR=0.91, 95% CI 0.83 to 0.99).

DISCUSSION

In our large prospective study of older Chinese, moderate drinking was associated with a higher risk of death from oesophageal cancer, but not with non-oesophageal cancer. In contrast, the most common drinking pattern, social drinking (<1/week) was unrelated to death from oesophageal cancer, but was associated with a lower risk of death from non-oesophageal cancer. Smoking was associated with alcohol use. These associations did not vary with smoking status, but the pattern was most evident after adjustment for smoking status. As such, these associations from a non-Western context do not suggest that moderate alcohol use protects against cancer; instead, they might suggest that attributes of being an occasional alcohol user are associated with a lower risk of cancer. Furthermore, the absence of a dose–response (except for oesophageal cancer) suggests that the effects of alcohol use were confounded by other factors that were socially mediated.

Despite a prospective design and a setting which may enable a better understanding of the effects of alcohol use because it was possible to distinguish between social (<1/week) and moderate drinkers, this study has limitations. First, alcohol use was self-reported, and we did not separate participants who regularly drank extremely small amounts from moderate drinkers in this study. Misclassification of alcohol use cannot be fully ruled out, and if this is the case, the effect of moderate drinking may be diluted. However, we assessed the validity of self-reported alcohol use using oesophageal cancer as a validation outcome. As expected, we found moderate and high alcohol use to be associated with higher risk of death from oesophageal cancer, and the estimates were of a similar magnitude as those previously reported,[21 22] indicating no significant measurement error. We also do not have detailed information on alcohol use from the participants, such as the exact amount of alcohol or the type of alcoholic beverage. However, the most common type of alcohol consumed among older people in Southern China is Chinese rice wine. Moreover, the information available is sufficient to distinguish between social and moderate drinkers. Moderate alcohol use also had the expected association with oesophageal cancer. Second, moderate drinkers are atypical in this population. The null estimate for the association of moderate drinking with all cancer had quite wide CIs, which does not preclude a small protective effect, but is consistent with a recent meta-analysis of 17 studies with narrower CIs (relative risk=1.02, 95% CI 0.99 to 1.06).[23] Third, the duration of alcohol use and the timing of quitting were not recorded. However, ex-drinkers were in poorer health as would be expected. Fourth, information on baseline cancer diagnoses was self-reported and subsequent incidence of cancer was not

Table 2 Adjusted HR and 95% CI for death from all cancer, non-oesophageal cancer and oesophageal cancer according to alcohol use among participants at Elderly Health Centres in Hong Kong from 1998 to 2001 with follow-up until 30 May 2012

		Alcohol use										
		Never	Social (<1/week)		Weekly social		Moderate		High		Ex-drinker	
Cancer	Model	HR	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
All cancer	1	1	0.95	0.88 to 1.03	1.10	0.89 to 1.36	1.16	1.02 to 1.32	1.79	1.46 to 2.20	1.19	1.10 to 1.29
	2	1	0.96	0.89 to 1.04	1.12	0.91 to 1.37	1.15	1.01 to 1.31	1.73	1.41 to 2.13	1.16	1.07 to 1.26
	3	1	0.88	0.81 to 0.96	0.98	0.80 to 1.21	0.99	0.87 to 1.12	1.36	1.11 to 1.67	1.04	0.96 to 1.13
All excluding	1	1	0.94	0.87 to 1.02	1.11	0.90 to 1.36	1.12	0.99 to 1.28	1.68	1.36 to 2.08	1.18	1.09 to 1.28
Oesophageal cancer	2	1	0.95	0.88 to 1.03	1.12	0.91 to 1.38	1.11	0.98 to 1.27	1.63	1.31 to 2.01	1.15	1.06 to 1.25
	3	1	0.88	0.81 to 0.95	0.99	0.80 to 1.22	0.96	0.84 to 1.09	1.28	1.03 to 1.58	1.04	0.95 to 1.13
Oesophageal cancer	1	1	1.44	0.82 to 2.53	0.81	0.11 to 5.91	3.75	1.97 to 7.13	9.61	4.42 to 20.91	1.85	1.06 to 3.23
	2	1	1.47	0.83 to 2.60	0.80	0.11 to 5.88	3.51	1.83 to 6.71	8.68	3.94 to 19.16	1.76	1.00 to 3.08
	3	1	1.34	0.75 to 2.38	0.73	0.10 to 5.34	3.15	1.62 to 6.09	6.63	2.92 to 15.02	1.53	0.85 to 2.73

Model 1: Adjusted for age and sex.
Model 2: Additionally adjusted for education, housing type, monthly expenditure, body mass index, exercise and health status.
Model 3: Additionally adjusted for smoking status, smoking×sex and smoking×age.

available. Participants with cancer at baseline may have changed their lifestyle, perhaps by reducing or quitting alcohol drinking, which would create a bias towards moderate alcohol use being associated with a lower risk of death from cancer. However, the associations of alcohol use with death from both non-oesophageal and oesophageal cancer were very similar after excluding participants with self-reported cancer at baseline or excluding deaths in the first 3 years after recruitment.

Our results are consistent with some studies in Asia. One prospective study in China with 15 years follow-up showed that low-to-moderate drinking was not associated with death from cancer.[24] Another cohort study in Japan found that moderate drinkers (<21 g/day) had similar risks of death from cancer as never drinkers, but occasional drinkers had lower risk.[25] On the other hand, a cohort study from Korea found that moderate drinking (<30 g/day) was associated with a lower risk of death from cancer for men, but not for women.[26] A study from Shanghai also reported that moderate alcohol use (<48 g/day) was associated with a lower risk of death from overall cancer in both sexes.[27] However, these two studies did not take advantage of the unique drinking patterns in this region to distinguish occasional social drinkers from regular moderate drinkers. In contrast, studies from Western settings usually find regular drinking of light-to-moderate amounts to be associated with a lower risk of cancer.[3 4 28 29] In prospective studies, regular drinking of one drink (about 12 g alcohol) per day, which is the most common drinking pattern, was associated with a lower risk of death from all cancer and some site-specific cancers such as oral cavity cancer and lung cancer.[3 4 29] Several meta-analyses, largely based on case-control studies, have found that light-to-moderate drinking (<25 g/day) was not associated with overall cancer but was associated with a higher risk of some specific cancers.[30 31] People diagnosed with cancer are more likely to reduce their alcohol use, which may overestimate the risk of moderate drinking with cancer.

There are several possible explanations for this inconsistency between our findings for moderate alcohol use and those generally seen in Western settings. About 50% of Chinese 'flush' and feel unwell on alcohol use because of a genetic variant, which results in slower metabolism of acetaldehyde.[32] However, alcohol users with such a slow metabolism have greater exposure to carcinogenic acetaldehyde. We do not have bio-materials or information on flushing in this cohort, so we cannot assess whether the effects of alcohol mainly occurred in those who metabolise acetaldehyde more slowly. As such, our study may overstate the harms of alcohol relative to other populations where such genetic polymorphisms are rare. Nevertheless, our findings would still be relevant to East Asians who form a substantial minority of the global population. Conversely, people who 'flush' on alcohol use may be more likely to be never drinkers. Given that acetaldehyde is ubiquitous and carcinogenic,[33 34] these never drinkers would also generally be more

Table 3 Number of deaths, adjusted* HR and 95% CI for death from various cancers according to alcohol use among participants at Elderly Health Centres in Hong Kong from 1998 to 2001 with follow-up until 30 May 2012

	Alcohol use group											
	Never		Social (<1/week)		Weekly social		Moderate		High		Ex-drinker	
Cancer	No.	HR	No.	HR (95% CI)	No.	HR (95% CI)	No.	HR (95% CI)	No.	HR (95% CI)	No.	HR (95% CI)
Head and neck	87	1	13	0.64 (0.35 to 1.18)	3	1.32 (0.41 to 4.27)	8	1.10 (0.51 to 2.36)	5	2.58 (1.00 to 6.67)	18	0.88 (0.51 to 1.54)
Lung	1269	1	260	0.85 (0.74 to 0.98)	28	0.83 (0.57 to 1.21)	98	0.93 (0.75 to 1.16)	45	1.39 (1.01 to 1.90)	258	0.93 (0.81 to 1.08)
Liver	382	1	69	0.81 (0.62 to 1.06)	11	1.15 (0.63 to 2.12)	30	1.16 (0.79 to 1.71)	8	1.12 (0.52 to 2.40)	90	1.28 (0.99 to 1.65)
Stomach	234	1	38	0.73 (0.50 to 1.05)	3	0.55 (0.17 to 1.73)	18	1.18 (0.71 to 1.95)	2	0.53 (0.13 to 2.15)	40	0.89 (0.62 to 1.30)
Colorectal	645	1	124	0.96 (0.78 to 1.18)	17	1.24 (0.75 to 2.06)	29	0.79 (0.54 to 1.16)	11	1.25 (0.68 to 2.30)	118	1.11 (0.89 to 1.37)
Pancreatic	160	1	32	1.15 (0.77 to 1.71)	4	1.49 (0.54 to 4.08)	4	0.54 (0.20 to 1.48)	4	1.71 (0.53 to 5.53)	38	1.63 (1.10 to 2.41)
Leukaemia	94	1	18	1.14 (0.68 to 1.94)	4	2.45 (0.88 to 6.82)	7	1.70 (0.76 to 3.84)	2	1.96 (0.46 to 8.28)	16	1.31 (0.75 to 2.31)

*Adjusted for age, sex, education, housing type, monthly expenditure, body mass index, exercise, health status, smoking status, smoking×sex and smoking×age.

Table 4 Sex-specific number of deaths, adjusted* HR and 95% CI for death from all cancer and various cancers according to alcohol use among participants at Elderly Health Centres in Hong Kong from 1998 to 2001 with follow-up until 30 May 2012

	Alcohol use group											
	Never		Social (<1/week)		Weekly social		Moderate		High		Ex-drinker	
Cancer	No.	HR	No.	HR (95% CI)	No.	HR (95% CI)	No.	HR (95% CI)	No.	HR (95% CI)	No.	HR (95% CI)
Men												
All	1352	1	527	0.89 (0.80 to 0.98)	73	1.03 (0.81 to 1.31)	241	1.02 (0.89 to 1.18)	96	1.43 (1.15 to 1.77)	589	1.06 (0.96 to 1.18)
All excluding oesophageal	1328	1	517	0.88 (0.80 to 0.98)	72	1.04 (0.82 to 1.32)	229	0.99 (0.86 to 1.14)	89	1.35 (1.08 to 1.69)	574	1.06 (0.95 to 1.17)
Head and neck	38	1	10	0.60 (0.30 to 1.23)	2	1.05 (0.25 to 4.43)	6	0.87 (0.36 to 2.09)	5	2.69 (1.02 to 7.07)	16	0.86 (0.47 to 1.58)
Oesophageal	24	1	10	1.00 (0.47 to 2.14)	1	0.80 (0.11 to 6.01)	12	2.94 (1.42 to 6.07)	7	5.49 (2.23 to 13.48)	15	1.53 (0.77 to 3.05)
Lung	428	1	174	0.82 (0.68 to 0.98)	18	0.69 (0.43 to 1.10)	86	0.92 (0.73 to 1.16)	45	1.45 (1.05 to 1.99)	185	0.91 (0.76 to 1.09)
Liver	144	1	53	0.86 (0.62 to 1.19)	9	1.17 (0.59 to 2.32)	28	1.24 (0.82 to 1.88)	8	1.27 (0.59 to 2.74)	69	1.25 (0.92 to 1.70)
Stomach	99	1	28	0.64 (0.41 to 1.00)	3	0.61 (0.19 to 1.94)	18	1.21 (0.72 to 2.04)	2	0.53 (0.13 to 2.18)	30	0.81 (0.52 to 1.27)
Colorectal	202	1	83	0.98 (0.76 to 1.28)	15	1.51 (0.87 to 2.61)	27	0.88 (0.59 to 1.33)	11	1.48 (0.80 to 2.74)	90	1.19 (0.91 to 1.55)
Prostate	97	1	32	0.92 (0.61 to 1.39)	3	0.83 (0.26 to 2.64)	11	0.87 (0.46 to 1.63)	2	0.77 (0.19 to 3.15)	36	1.12 (0.74 to 1.69)
Pancreatic	37	1	23	1.59 (0.93 to 2.73)	4	2.58 (0.90 to 7.39)	4	0.74 (0.26 to 2.09)	3	1.53 (0.36 to 6.51)	23	1.75 (1.00 to 3.05)
Leukaemia	19	1	11	1.51 (0.70 to 3.26)	2	2.25 (0.51 to 9.91)	7	2.45 (1.00 to 6.00)	2	2.74 (0.61 to 12.29)	9	1.64 (0.71 to 3.79)
Women												
All	2928	1	255	0.89 (0.78 to 1.01)	20	0.87 (0.56 to 1.35)	29	0.88 (0.61 to 1.27)	5	0.84 (0.35 to 2.03)	220	0.99 (0.86 to 1.14)
All excluding oesophageal	2894	1	248	0.88 (0.77 to 0.99)	20	0.88 (0.57 to 1.37)	28	0.86 (0.59 to 1.25)	4	0.69 (0.26 to 1.84)	217	0.99 (0.86 to 1.14)
Head and neck	49	1	3	0.74 (0.23 to 2.39)	1	2.46 (0.33 to 18.32)	2	4.12 (0.97 to 17.47)	0		2	0.67 (0.16 to 2.80)
Oesophageal	34	1	7	2.20 (0.96 to 5.06)	0		1	2.62 (0.35 to 19.60)	1	15.44 (1.97 to 120.85)	3	1.10 (0.32 to 3.70)
Lung	841	1	86	0.91 (0.73 to 1.14)	10	1.27 (0.68 to 2.37)	12	0.98 (0.55 to 1.75)	0		73	0.96 (0.75 to 1.24)
Liver	238	1	16	0.70 (0.42 to 1.17)	2	1.11 (0.28 to 4.54)	2	0.83 (0.20 to 3.34)	0		21	1.27 (0.79 to 2.03)
Stomach	135	1	10	0.96 (0.50 to 1.85)	0		0		0		10	1.21 (0.63 to 2.34)
Colorectal	443	1	41	0.98 (0.71 to 1.35)	2	0.61 (0.15 to 2.47)	2	0.46 (0.11 to 1.83)	0		28	0.96 (0.65 to 1.41)
Breast	127	1	10	0.87 (0.45 to 1.67)	0		0		0		6	0.76 (0.33 to 1.75)
Pancreatic	123	1	9	0.75 (0.38 to 1.48)	0		0		1	4.60 (0.63 to 33.55)	15	1.67 (0.94 to 2.97)
Leukaemia	75	1	7	0.95 (0.43 to 2.07)	2	3.26 (0.79 to 13.48)	0		0		7	1.19 (0.53 to 2.64)

*Adjusted for age, education, housing type, monthly expenditure, body mass index, exercise, health status, smoking status and smoking×age.

susceptible to cancer; thus, our study may have understated the harms of alcohol. Despite these possibilities, our study is likely to be internally consistent. Occasional and infrequent use of alcohol is unlikely to have any biological effect. Correspondingly, occasional alcohol use had no association with death from oesophageal cancer. However, occasional alcohol use was associated with a lower risk of death from non-oesophageal cancer, which is probably due to the health-related attributes of being an occasional social drinker rather than any biological effects of alcohol. As such, attributes of being an occasional social drinker rather than the biological effects of alcohol may underlie the observed associations in both Southern Chinese population and Western populations. Notably, in Western populations, moderate alcohol use tends to be defined as the level of alcohol intake corresponding to the lowest overall risk of morbidity or mortality in a population, making moderate users healthier than other alcohol users,[35] and inevitably generating such apparent protective associations.

Consistent with studies from Western and non-Western populations,[36 37] high alcohol consumption was associated with a higher risk of death from oesophageal cancer, head and neck cancer and lung cancer. DNA adducts of acetaldehyde and alcohol-related lipid peroxides can promote carcinogenesis and mutagenesis.[38 39] Ex-drinkers had a higher risk of death from pancreatic cancer. People may give up drinking because of diabetes, which is also associated with death from pancreatic cancer.[40]

In conclusion, in older people from an understudied Southern Chinese population, the expected harms from high levels of alcohol use were seen, as high levels of alcohol use were associated with death from cancer. In this non-Western setting, where moderate alcohol use is an atypical drinking pattern, moderate alcohol use was associated with a higher risk of death from oesophageal cancer, but not from non-oesophageal cancer. In contrast, in a setting where occasional social alcohol use (<1/week) is the typical drinking pattern, it was not associated with oesophageal cancer, but was associated with a lower risk of death from non-oesophageal cancer. Although we cannot rule out the possibility of some protective effect of infrequent alcohol use on cancer, our study also raises the possibility that attributes of being a typical alcohol user in any setting protect against cancer, rather than protective biological effects of occasional or moderate alcohol use.

What is already known on this subject

- In the West, moderate alcohol use, as the typical drinking pattern, was associated with a lower risk of death from cancer. However, drinking is social patterned and it is unclear whether this association is due to biological pathways or residual confounding. Therefore, reassessing the same question in a different social context may help clarify the underlying mechanisms.

What this study adds

- Our study prospectively showed that moderate alcohol use was not associated with a lower risk of death from cancer; instead, occasional alcohol use, the typical drinking pattern in our setting, was associated with a lower risk of death from cancer.
- It is more likely that the observed associations of moderate alcohol use with cancer are due to other protective factors associated with being a typical, occasional social drinker, rather than the protective biological effects of occasional or moderate alcohol use.

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