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**Original Article:**

**The association between alcohol consumption and mortality: the Swedish Women's Lifestyle and Health Study**

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## **Abstract**

Although light to moderate alcohol intake may reduce cardiovascular disease (CVD) mortality, the effect on total mortality requires further study, particularly among young and middle-aged women. We studied the association between alcohol consumption and mortality from all causes, from cancer, and from CVD in the Swedish Women's Lifestyle and Health Study, a cohort of 47,921 female residents of Sweden aged 30 to 49 years at baseline in 1991/1992 and followed up to 2006. We estimated the relative risk (RR) of mortality associated with alcohol intake using Cox regression adjusted for age, smoking, BMI, saturated fat intake, physical activity, and education. During 713,295 person-years of follow-up, 1,119 deaths occurred, including 158 deaths from CVD, 673 deaths from cancer, and 288 deaths from other causes. Compared with non-drinking, light to moderate drinking (0.1-19.9 grams of alcohol per day) showed a statistically significant inverse association with total mortality (RR=0.83, 95% CI=0.71-0.98). Analyses of cause-specific mortality revealed an RR for CVD mortality of 0.69 (95% CI=0.46-1.01) and an RR for cancer mortality of 0.92 (95% CI=0.75-1.15). These results suggest that in younger women, a possibly beneficial effect of light to moderate drinking on future risk of mortality is limited to a prevention of CVD mortality but not cancer mortality.

## **Introduction**

Alcohol consumption plays an important role in numerous cultures, in particular in Western societies. The adverse effects of excessive alcohol consumption on health and mortality are well established (1). It is also widely believed that modest alcohol consumption is beneficial to health (1). However, the effects of alcohol on health may differ according to sex, age, and ethnicity (1-3). In addition, there has been concern about potential bias due to the mutual inclusion of lifetime abstainers, former heavy drinkers, and those who stopped consuming alcohol due to poor health into a single reference group of non-drinkers (2, 4, 5). A further concern is that light to moderate alcohol drinking may reduce risk of mortality from cardiovascular disease (CVD), in particular mortality from coronary heart disease (CHD) (6, 7), but that even modest intake of alcohol may adversely affect cancer mortality (8, 9). To further explore these issues, we examined the association between alcohol intake and mortality from any cause, CVD mortality, and cancer mortality in the Swedish Women's Lifestyle and Health Study with nearly 50,000 women living in Sweden. The cohort includes a large number of light to moderate drinkers, a level of alcohol intake that is considered controversial in terms of its potential health benefits. Furthermore, the cohort's baseline age range of 30 to 49 years is exceptional: previous studies have looked either at a much broader age range (9-11) or at older women (12, 13).

## **Methods**

### *The cohort*

The Women's Lifestyle and Health (WLH) cohort is a prospective study of women that was approved by the Ethical Committee of the Karolinska Institute Stockholm and then initiated between August 1991 and June 1992 in the Uppsala Health Care Region, Sweden, when 96,000 female residents aged 30 to 49 years were randomly selected and posted a self-report

questionnaire. Of these, 49,259 women gave their informed consent and were enrolled in the WLH study. A follow-up questionnaire was sent between February 2003 and January 2004, which a total of 34,402 women completed. Both questionnaires requested information regarding anthropometric measurements, personal history of diseases, smoking and drinking habits, diet, and physical activity.

#### *Assessment of alcohol intake*

On the baseline questionnaire, each woman was asked to report the number of glasses of beer (1 glass=2 dl), wine (1 glass=1dl), and spirits (1 glass=4 cl) that she currently drank per week, per month, or per year. The woman could also report that she never or seldom drank alcohol. The reported quantities of beer, wine and spirits were converted to grams of alcohol using food composition data from the Swedish National Food Administration (14). The follow-up questionnaire contained a corresponding question regarding alcohol intake although the frequencies and quantities were somewhat differently formulated. The reported quantities of beer, wine and spirits were converted into quantities of alcohol in the same manner as those from the baseline questionnaire.

#### *Analytic cohort*

For the current analysis, we excluded 484 women with incomplete baseline information on alcohol or total energy intake, 984 women with extreme energy intakes (top or bottom 1% of the energy intake distribution), and 10 women who completed the baseline questionnaire but were later found to have emigrated from Sweden immediately afterwards, which left 47,921 women for our main analysis.

### *Endpoint definition*

Cohort members were followed from August 1991 through December 31, 2006 by linking the cohort to the national registers (Death Register, Cancer Register, and Immigration Register) through their unique national registration numbers (15), making follow-up virtually complete (16, 17). Cases of mortality were identified by the International Classification of Diseases codes (ICD-9 and ICD-10). The primary endpoint for the present analysis was mortality from any cause. In secondary analyses, we considered mortality from cancer (ICD-9 140-209 or ICD-10 C00-D09), CVD (ICD-9 390-459 or ICD-10 I00-I99), and non-cancer/non-CVD causes (ICD-9 001-139, 210-389, 460-999 or ICD-10 A00-B99, D10-H95, J00-Z99).

### *Statistical main analysis*

Each study participant accrued follow-up time beginning at the date of return of the baseline questionnaire and ending at the date of death, emigration, or the end of follow-up in December 31, 2006, whichever occurred first. Following the Nurses' Health Study (18) as closely as the number of cases allowed, alcohol intake categories were defined as 0, 0.1-1.4, 1.5-4.9, 5.0-9.9, 10.0-14.9, and 15.0+ grams of alcohol per day. For example, the category of 1.5-4.9 grams of alcohol per day corresponds to approximately two glasses of wine per week (1 glass = 1dl; alcohol by volume = 10%). To further facilitate comparison with previous studies, we also compared subjects with 0.1-19.9 grams of alcohol per day with subjects with no alcohol consumption (11, 19-21) as well as participants consuming any quantity of alcohol with non-drinkers (12, 13, 22). We fitted Cox proportional hazards regression models to estimate the relative risks of mortality associated with alcohol intake. We verified that the assumption of proportional hazards was not violated using Schoenfeld residuals (23).

For age-adjusted analyses, we used five-year age groups at baseline. In multivariable models, we additionally adjusted for body mass index (BMI) (<18.5, 18.5-24.9, 25.0+ kg/m<sup>2</sup>), energy-adjusted (24) saturated fat intake (grams per day in quintiles), smoking status (never, past, and current smoking with current intensities of 1-14, 15-24, 25+ cigarettes per day), level of physical activity [derived from the original self-assessment scale of 1 through 5 (very low to very high level of physical activity, considering both working and leisure time) as low (1 or 2), intermediate (3), or high (4 or 5)], and education level (0-10, 11-13, 14+ years). For tests of linear trend across categories of alcohol intake, we assigned each categorical alcohol value the median alcohol intake within that category and determined the P value of the resulting continuous variable using the Wald test.

All relative risks (RRs) are presented with 95% confidence intervals (CI), and reported P values are based on two-sided tests at the 5% significance level. All analyses were conducted using the statistical software SAS release 9.2 (SAS Institute, Cary, NC).

### *Statistical sub-analyses*

Firstly, to assess potential bias by preclinical chronic disease, we repeated the analysis excluding all women with pre-existing hypertension, type 2 diabetes mellitus, or cancer and additionally excluded the first two years of follow-up for all women. Secondly, to investigate consistent drinking patterns we used data on consistent drinking versus consistent alcohol avoidance from both the baseline and the 2003 follow-up questionnaires, restricting the analysis to deaths that occurred between 2003 and 2006. Thirdly, we addressed potential confounding due to including past heavy drinkers in the reference group of non-drinkers by excluding non-drinkers in 2003 who had previously reported alcohol intake of 10 grams per day or more in 1991/1992. Fourthly, to examine whether the association of alcohol to



mortality was modified by other risk factors for mortality, we conducted tests for multiplicative interaction using likelihood-ratio tests. We also evaluated the relation of alcohol to mortality within strata of potential effect modifying variables. Fifthly, we performed mortality type specific analyses analogously to the all-cause mortality investigations.

Finally, we conducted beverage type specific analyses for wine, beer and spirits, classified as 0, 0.1-1.4, 1.5-4.9, or 5.0+ grams per day. These analyses were mutually adjusted for alcohol intake from other beverage types, e.g. the wine analysis was adjusted for beer and spirits intakes.

## **Results**

### *Distribution of events and alcohol intake*

During 713,295 person-years of follow-up between 1991 and 2006, a total of 1,119 deaths occurred, including 673 deaths from cancer (184 from breast cancer, 122 from cancers of the trachea, bronchus, and lung, and 60 from ovarian cancer), 158 from CVD (69 from CHD, 12 from stroke, and 77 from other CVD-related causes), 54 deaths from injury or poisoning, 39 deaths from suicide, and 195 deaths from other causes. Censoring events were distributed between 7 days and 15.3 years after study entry, with a mean censoring time of 15.0 years. Deaths occurred between 68 days and 15.3 years after study entry with a mean of time to death of 9.2 years. Thirty subjects died and 79 subjects were censored within one year of entry. The mean ages at baseline and at the end of follow-up were 39.2 years and 54.3 years, respectively.

Of the 47,921 women in our analytic cohort, 13.4% declared no alcohol intake, the majority of women (84.5%) reported alcohol intakes of 0.1 to 14.9 grams per day, and 2.1% of participants stated an average daily alcohol intake of 15 grams or more at baseline. The vast majority (over 99%) of women consumed less than 20 grams of alcohol per day. In the intake groups of 0, 0.1-1.4, 1.5-4.9, 5.0-9.9, and 10.0-14.9 grams of alcohol per day, deaths were mainly attributed to breast cancer (14-19% of all deaths) or to cancers of the trachea, bronchus or lung (9-13%). By comparison, in the highest intake group of 15.0+ grams of alcohol or more per day, the top two causes of mortality were injury/poisoning (12%) and breast cancer (8%). The correlation coefficient between wine and beer intake was 0.11, between wine and spirits intake it was 0.15, and between beer and spirits intake it was 0.16, implying that study participants showed no strong preference for the combination of any two alcoholic beverage types.

#### *Distribution of risk factors at baseline*

We present summary statistics of potentially confounding factors by categories of total alcohol intake (Table 1). With increasing total alcohol intake, women were more likely to be past or current smokers, which would tend to increase the risk of mortality. On the other hand, women with greater total alcohol consumption were better educated, they showed less saturated fat intake, and they were less likely to have been diagnosed with diabetes than women who abstained from alcohol, a risk factor profile that would tend to decrease risk of mortality. Physical activity, which also tends to decrease mortality risk, was highest among women in the intermediate alcohol categories between 1.5 and 14.9 grams per day. BMI and history of hypertension did not vary appreciably according to alcohol intake. Corresponding figures for baseline characteristics by specific alcoholic beverage types can be found in the (web-based) Supplementary Table 1.

### *All-cause mortality*

We investigated the relation of total alcohol intake to all-cause mortality using the zero intake group as reference (Fig. 1). In multivariable analyses, we inspected the mortality risk in the intake groups 0.1-1.4, 1.5-4.9, 5.0-9.9, 10.0-14.9, and 15.0+ grams of alcohol per day compared to alcohol abstinence and found null associations for all levels with the exception of one category: for 1.5-4.9 grams of alcohol per day the association proved to be statistically significant and inverse (RR=0.81, 95% CI=0.67-0.97). Statistically significant inverse associations were also found for the larger group of 0.1-19.9 grams of alcohol intake per day (RR=0.83, 95% CI=0.71-0.98) versus none, and for any versus no alcohol intake (RR=0.84, 95% CI=0.71-0.98). Adjusting for hypertension status and diabetes status did not appreciably affect the results (data not shown). Excluding women with a history of hypertension, type 2 diabetes mellitus, or cancer at baseline and excluding the first two years of follow-up did not essentially alter the results (data not shown). In 2003, 10.3% of women were non-drinkers, 80.7% of women stated an alcohol intake of 0.1 to 14.9 grams per day, and 9.0% of women consumed over 15 grams of alcohol per day. Over 95% of women reported an alcohol intake less than 20 grams of alcohol per day in 2003. Age-adjusted analyses revealed that women consistently reporting alcohol use in 1991/1992 and in 2003 had a statistically significant lower mortality risk between 2003 and 2006 than consistent non-drinkers (RR=0.64, 95% CI=0.41-1.00). Exclusion of potential former heavy drinkers from the non-drinking group did not alter those results.

### *Cause-specific mortality*

We examined the relation between alcohol intake and mortality from specific causes (Table 2). In analyses adjusted for potential confounding factors, we observed an RR for CVD

mortality of 0.69 (95% CI=0.46-1.01) comparing an alcohol intake of 0.1-19.9 grams per day with no alcohol intake and an RR for cancer mortality of 0.92 (95% CI=0.75-1.15) comparing an alcohol intake of 0.1-19.9 grams per day with no alcohol intake.

#### *Analyses within strata of mortality risk factors*

In multivariable analyses, we looked at associations between alcohol and mortality within strata of other risk factors (Table 3). In women aged 30 to 34 years at baseline, the highest intake group of 15 grams of alcohol per day or more revealed a statistically significant increase in total mortality risk (RR=3.11, 95% CI=1.18-8.20) compared to no alcohol intake, while the intermediate intake levels showed null associations. In contrast, among women aged 35 to 49 years at baseline the highest intake group of more than 15 grams of alcohol per day showed the strongest, statistically significant risk reduction (RR=0.55, 95% CI=0.34-0.90) compared to non-drinkers. In that age group, intake levels 0.1-1.4 grams of alcohol per day (RR=0.81, 95% CI=0.67-0.99) and 1.5-4.9 grams of alcohol per day (RR=0.76, 95% CI=0.63-0.92) were statistically significantly and inversely associated with mortality (P value for interaction by age=0.047). The association between alcohol and mortality did not vary across strata defined by BMI, saturated fat intake, smoking, history of hypertension, type 2 diabetes mellitus, physical activity, or education (data not shown).

#### *Specific alcoholic beverage types*

We also performed analyses by specific alcoholic beverage type (Table 4). The only statistically significant results from the multivariable analyses were as follows: compared to zero beer intake, 0.1-1.4 grams of alcohol per day from beer intake (RR=0.83, 95% CI=0.72-0.96) and 1.5-4.9 grams of alcohol per day from beer intake (RR=0.83, 95% CI=0.70-0.98) were inversely associated with total mortality. In contrast, we noted a statistically significant

positive association for women with an average daily alcohol from spirits intake of 5 grams or more (RR=1.52, 95% CI=1.04-2.22, p-trend=0.05).

## Discussion

In this cohort of mostly light to moderate drinking women aged 30 to 49 years at baseline compared to non-drinkers, we observed an approximately 20 to 30% apparent reduction in mortality risk for various categories of alcohol intake within the range of 1.5 to 20 grams per day, with an overall 16% reduction in risk for mortality when we compared women with any versus no alcohol intake. We were unable to assess the association with alcohol intake beyond 20 grams per day because of insufficient numbers of women (1% of women in our cohort).

A study from England and Wales revealed that as age increases, the level of alcohol intake associated with maximal risk reduction increases as well, suggesting that results from cohorts with different age distributions cannot be strictly compared (3). The study most closely related to ours with respect to its age and sex structure and alcohol and mortality results is the Nurses' Health Study with an analytic sample of 86,000 women aged 35 to 59 years at baseline (18). That study revealed a statistically significant inverse relation of alcohol intake to mortality for an intake range of 1.5 to 14.9 grams per day (RR for 1.5 to 4.9 grams per day=0.83; 95% CI=0.74-0.93; RR for 5.0 to 14.9 grams per day=0.88; 95% CI=0.79-0.99) with estimates similar to ours. Studies with wider age ranges than ours or with partly overlapping age structures also detected statistically significant inverse (9-11, 25, 26) or null (19-21) associations between alcohol intakes of up to 20 grams per day and all-cause mortality. Studies in women over age 50 years also found statistically significant mortality risk reductions associated with any versus no alcohol intake (12, 13). One combined analysis in men and women over age 50 years confirmed a statistically significant risk reduction for

any versus no alcohol intake (22), another detected statistically significant risk reductions for alcohol intakes of up to 28 grams per day only (27).

In the youngest women in our cohort, i.e., in those aged 30 to 34 years at baseline, alcohol intake of 15 grams or more per day was associated with increased mortality risk, whereas in women aged 35 years or older at baseline alcohol consumption of 15 grams per day of alcohol or more was related to decreased mortality risk. The Nurses' Health Study also found that for any given level of alcohol intake, the apparent adverse effect of alcohol on risk for mortality was consistently more pronounced among younger than older women (18), ranging from RR=2.46 (95% CI=0.50-12.4) for women aged 34 to 39 years to RR=1.02 (95% CI=0.80-1.30) for women over 60. Similar conclusions were reached by the Japanese Collaborative Cohort Study (11, 28) and the National Health Epidemiology Follow-up Study (11, 28).

In our study, a null association was observed between alcohol consumption and cancer mortality. Similarly, the Nurses' Health Study detected a null association for cancer mortality with alcohol intake up to 30 grams per day (18, 29). A modest positive association was observed for intake levels of 30 grams per day or more in the Nurses' Health Study (18, 29). Other studies showed statistically significant positive (4, 8, 9) or null (11) associations between alcohol and cancer mortality in women or in men and women combined (30).

We noted an inverse association between low alcohol intake (1.5 to 4.9 grams and 0.1-19.9 grams of alcohol per day) and mortality from CVD. The Nurses' Health Study observed statistically significant decreased risks of CVD mortality with 1.5 to 4.9 grams (RR=0.57; 95% CI=0.43-0.76), 5.0 to 14.9 grams (RR=0.73; 95% CI=0.56-0.95), and 15.0 to 29.9 (RR=0.66; 95% CI=0.47-0.93) grams of alcohol intake per day (18, 29). Other studies also

revealed inverse relations between alcohol intake and CVD (or CHD) mortality in women (9, 25, 31, 32) or in men and women combined (22, 30). Non-linear inverse associations for low alcohol intakes and positive (33) or null (4, 7, 8, 10) associations for higher alcohol intakes were also identified in numerous studies among women.

Similar to our study, most other studies found an inverse association between beer consumption and mortality in women (12, 13, 34) or in men and women combined (30, 32). Only few studies reported a positive relation of beer to mortality (20, 35). Inverse associations between wine intake and mortality risk were noted in studies among women (4, 12, 20, 34, 35) or in analyses involving both women and men (30, 32). We observed a positive association between spirits intake and risk of mortality. Previous studies reported inverse (12), null (20, 34), or positive (35) relations between spirits intake and mortality risk. Previous analyses combining men and women showed null (32) or positive (30, 36) associations.

One of our study's strengths is its particular age and sex structure of younger women. Further merits are that potential recall bias was precluded by the prospective study design, potential information bias was minimized by the reasonably valid and reliable food frequency questionnaire comparable to that used in a similar study (37), and potential selection bias was avoided by the virtually complete follow-up. In addition, we minimised the potential for confounding by controlling for numerous accepted risk factors for mortality. Since previous studies reported both greater (2, 4, 5, 26, 35, 38, 39) or lower mortality risk (11, 20) among female former drinkers compared to female lifetime abstainers, we were concerned with potential bias through the inclusion of ill former heavy drinkers in the reference group, but found that the exclusion of former drinkers did not alter our results. Our study had limited

power to explore associations with specific causes of mortality and mortality among women with alcohol intakes with over 20 grams per day.

Moderate intake of ethanol could prevent CVD by numerous biological mechanisms, such as improving endothelial function, lowering blood pressure, reducing inflammation, increasing high density lipoprotein (HDL) cholesterol and decreasing low density lipoprotein (LDL) cholesterol, enhancing fibrinolysis, inhibiting platelet aggregation and coagulation, attenuating insulin resistance, and releasing stress (6, 40, 41). In addition to ethanol, other components of alcoholic beverages, thus as flavonoids and resveratrol, prevent CVD in ways similar to ethanol (6). An open issue is whether the apparent benefit of ethanol for vascular health depends on alcoholic beverage type. A meta-analysis reported inverse relations of both wine and beer intake to CVD risk that was greater for wine than for beer intake (42).

Divergent beverage type-specific results might arise due to residual confounding by sociodemographic or lifestyle factors; the greatest risk reductions were typically observed for the alcoholic beverage type predominantly consumed in the specific population under study (4, 43).

In conclusion, we observed a moderate reduction in total and CVD mortality but not in cancer mortality among women with any versus no alcohol intake. These results, broadly consistent with findings from previous studies, suggest a beneficial effect of light to moderate drinking on women's health. Despite the apparent benefits of moderate alcohol intake for mortality risk, health care providers should discuss the potential hazards of alcohol consumption with their patients and provide them with an individual clinical recommendation.



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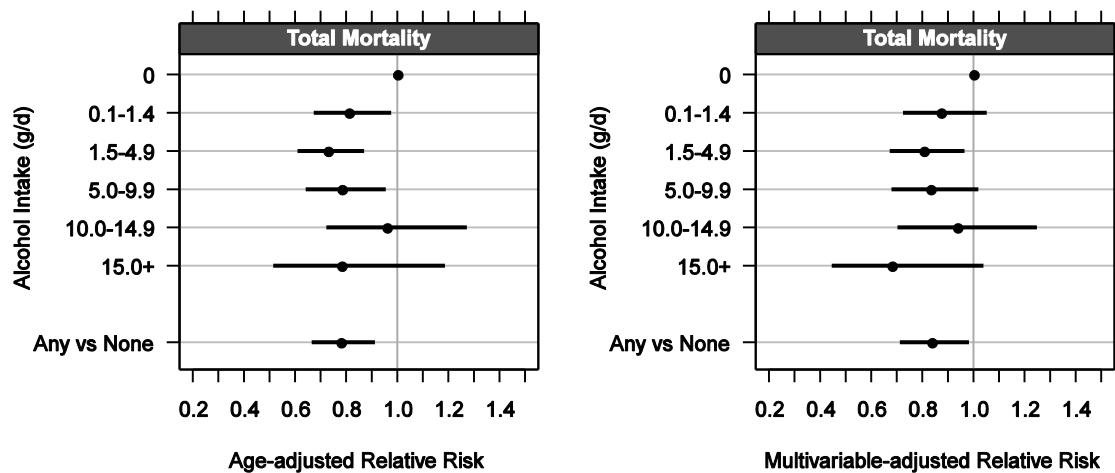
**Table 1.** Age-standardized<sup>a</sup> baseline characteristics according to alcohol intake among women in the Swedish Women's Lifestyle and Health Study (Aug 1991 - Jun 1992)

	Total Alcohol Intake (g/day)					
	0	0.1-1.4	1.5-4.9	5.0-9.9	10.0-14.9	15.0+
<b>Subjects (n)</b>	6,428	12,241	17,228	8,848	2,174	1,002
<b>Age at enrolment (years)</b>	39.1	38.9	39.0	39.7	40.2	40.5
<b>Alcohol intake (g/day)</b>						
Total alcohol	0.0	0.7	3.0	6.9	12.0	22.2
Wine	0.0	0.3	1.3	3.2	5.9	10.9
Beer	0.0	0.3	1.4	2.8	4.5	7.6
Spirits	0.0	0.1	0.4	0.8	1.6	3.7
<b>BMI (kg/m<sup>2</sup>)</b>	24.2	23.7	23.3	23.1	23.1	23.5
<b>Saturated fat intake<sup>b</sup> (g/day)</b>	24.1	24.4	24.3	23.9	23.9	22.3
<b>Smoking intensity among current smokers (cigs/day)</b>	14.0	12.8	12.4	12.6	13.8	15.2
<b>Smoking status (%)</b>						
Never	50	47	41	32	26	17
Past	23	27	32	35	35	34
Current	26	26	28	33	39	49
<b>History of prevalent disease (%)</b>						
Hypertension	11	9	9	8	9	10
Diabetes	2	1	1	1	1	1
<b>Physical activity (%)</b>						
Low	18	15	13	14	16	23
Intermediate	64	62	59	57	56	53
High	19	23	27	28	28	24
<b>Years of education<sup>c</sup> (%)</b>						
0-10	41	32	27	25	26	25
11-13	36	40	41	39	36	36
14+	23	28	32	37	38	39

<sup>a</sup> Using direct standardization to the baseline age distribution of the cohort

<sup>b</sup> Energy-adjusted with the residual method (Willett 1997)

<sup>c</sup> Ten years of education correspond to completion of compulsory school; 13 years of education correspond to completion of secondary school; 14 years of education or more correspond to graduate study at a university.



**Fig 1.** Relative Risk of Mortality from any Cause in Relation to Average Daily Total Alcohol Intake Among Swedish Women: The Swedish Women's Lifestyle and Health Study, 1991-2006. The *age-adjusted relative risks* were: RR for zero alcohol intake=1 (ref.); RR for 0.1-1.4 grams per day=0.81; 95% CI=0.67-0.98; RR for 1.5-4.9 grams per day=0.73; 95% CI=0.61-0.87; RR for 5.0-9.9 grams per day=0.78; 95% CI=0.64-0.95; RR for 10.0-14.9 grams per day=0.96; 95% CI=0.72-1.27; RR for 15.0+ grams per day=0.78; 95% CI=0.51-1.19; RR for any alcohol intake=0.78; 95% CI=0.66-0.91. The *multivariable-adjusted relative risks* were: RR for zero alcohol intake=1 (ref.); RR for 0.1-1.4 grams per day=0.87; 95% CI=0.72-1.05; RR for 1.5-4.9 grams per day=0.81; 95% CI=0.67-0.97; RR for 5.0-9.9 grams per day=0.83; 95% CI=0.67-1.01; RR for 10.0-14.9 grams per day=0.94; 95% CI=0.70-1.25; RR for 15.0+ grams per day=0.68; 95% CI=0.45-1.04; RR for any alcohol intake=0.84; 95% CI=0.71-0.98. Multivariable-adjusted relative risks were adjusted for age (5-year categories), BMI (<18.5, 18.5-24.9, 25.0+ kg/m<sup>2</sup>), energy-adjusted saturated fat intake (quintiles), smoking status (never, past, and current smoking with current intensities of 1-14 cigs/day, 15-24 cigs/day, and 25+ cigs/day), current physical activity (low, intermediate, high), years of education (0-10, 11-13, 14+ years, where ten years of education correspond to completion of compulsory school, 13 years of education correspond to completion of secondary school, and 14 years of education or more correspond to graduate study at university).

**Table 2.** Relative Risk of Cause-specific Mortality in Relation to Average Daily Total Alcohol Intake Among Swedish Women: The Swedish Women's Lifestyle and Health Study, 1991-2006.

Cause-specific Mortality	Total Alcohol Intake (g/day)	Cases	Person-years	Relative Risk (95% CI) <sup>a</sup>	
				Age-adjusted	Multivariable-adjusted <sup>b</sup>
Cancer-related	0	101	95,232	1.00 (ref.)	1.00 (ref.)
	0.1-1.4	179	182,521	0.94 (0.74-1.20)	0.99 (0.78-1.27)
	1.5-4.9	227	257,081	0.85 (0.67-1.07)	0.91 (0.72-1.16)
	5.0-9.9	116	131,392	0.80 (0.61-1.04)	0.84 (0.64-1.10)
	10.0+	50	47,069	0.90 (0.64-1.27)	0.87 (0.62-1.23)
	p-trend			0.13	0.07
	<i>0.1-19.9 (compared to none)</i>		567	612,315	0.87 (0.70-1.07)
<i>Any (compared to none)</i>		572	618,063	0.87 (0.70-1.07)	0.92 (0.74-1.14)
CVD-related	0	33	95,232	1.00 (ref.)	1.00 (ref.)
	0.1-1.4	41	182,521	0.66 (0.42-1.04)	0.76 (0.48-1.20)
	1.5-4.9	40	257,081	0.46 (0.29-0.73)	0.57 (0.36-0.91)
	5.0-9.9	34	131,392	0.71 (0.44-1.15)	0.85 (0.52-1.38)
	10.0+	10	47,069	0.55 (0.27-1.12)	0.55 (0.27-1.12)
	p-trend			0.30	0.26
	<i>0.1-19.9 (compared to none)</i>		123	612,315	0.58 (0.39-0.85)
<i>Any (compared to none)</i>		125	618,063	0.58 (0.40-0.85)	0.69 (0.46-1.01)
Neither cancer- nor CVD-related	0	50	95,232	1.00 (ref.)	1.00 (ref.)
	0.1-1.4	62	182,521	0.65 (0.45-0.95)	0.70 (0.48-1.02)
	1.5-4.9	89	257,081	0.67 (0.47-0.94)	0.72 (0.51-1.03)
	5.0-9.9	57	131,392	0.80 (0.55-1.18)	0.82 (0.55-1.20)
	10.0+	30	47,069	1.14 (0.73-1.80)	0.98 (0.62-1.57)
	p-trend			0.03	0.24
	<i>0.1-19.9 (compared to none)</i>		230	612,315	0.71 (0.53-0.97)
<i>Any (compared to none)</i>		238	618,063	0.73 (0.54-0.99)	0.76 (0.56-1.03)

<sup>a</sup> CI=confidence interval

<sup>b</sup> Adjusted for age (5-year categories), BMI (<18.5, 18.5-24.9, 25.0+ kg/m<sup>2</sup>), energy-adjusted saturated fat intake (quintiles), smoking status (never, past, and current smoking with current intensities of 1-14 cigs/day, 15-24 cigs/day, and 25+ cigs/day), current physical activity (low, intermediate, high), years of education (0-10, 11-13, 14+ years, where ten years of education correspond to completion of compulsory school, 13 years of education correspond to completion of secondary school, and 14 years of education or more correspond to graduate study at university).



**Table 3.** Multivariable Relative Risks of Total Mortality in Relation to Average Daily Total Alcohol Intake, Stratified by Age, Among Swedish Women: The Swedish Women's Lifestyle and Health Study, 1991-2006.

Stratum	Total Alcohol Intake (g/day)	Cases	Person-years	Multivariable-adjusted Relative Risk (95% CI) <sup>a</sup>
<b>Age at enrolment (years)</b>				
30-34	0	17	27,596	1.00 (ref.)
	0.1-1.4	44	52,939	1.51 (0.86-2.64)
	1.5-4.9	45	69,829	1.24 (0.70-2.18)
	5.0-9.9	18	29,652	1.16 (0.59-2.27)
	10.0-14.9	3	6,407	0.81 (0.23-2.77)
	15.0+	6	2,570	3.11 (1.18-8.20)
35-49	0	167	67,637	1.00 (ref.)
	0.1-1.4	238	129,582	0.81 (0.67-0.99)
	1.5-4.9	311	187,252	0.76 (0.63-0.92)
	5.0-9.9	189	101,740	0.82 (0.66-1.01)
	10.0-14.9	62	25,799	0.98 (0.73-1.31)
	15.0+	19	12,292	0.55 (0.34-0.90)

<sup>a</sup> CI=confidence interval; relative risks adjusted for age (5-year categories), BMI (<18.5, 18.5-24.9, 25.0+ kg/m<sup>2</sup>), energy-adjusted saturated fat intake (quintiles), smoking status (never, past, and current smoking with current intensities of 1-14 cigs/day, 15-24 cigs/day, and 25+ cigs/day), current physical activity (low, intermediate, high), years of education (0-10, 11-13, 14+ years, where ten years of education correspond to completion of compulsory school, 13 years of education correspond to completion of secondary school, and 14 years of education or more correspond to graduate study at university).

**Table 4.** Relative Risk of Mortality from any Cause in Relation to Average Daily Beverage-type-specific Alcohol Intake Among Swedish Women: The Swedish Women's Lifestyle and Health Study, 1991-2006.

Alcohol intake (g/day)	Cases	Person-years	Relative Risk (95% CI) <sup>a</sup>	
			Age-adjusted <sup>b</sup>	Multivariable-adjusted <sup>c</sup>
<i>Wine</i>				
0	388	205,488	1.00 (ref.)	1.00 (ref.)
0.1-1.4	389	283,554	0.83 (0.71-0.97)	0.91 (0.78-1.06)
1.5-4.9	223	156,447	0.79 (0.66-0.94)	0.88 (0.74-1.06)
5.0+	119	67,805	0.82 (0.66-1.01)	0.85 (0.69-1.06)
p-trend			0.07	0.18
<i>Beer</i>				
0	393	199,366	1.00 (ref.)	1.00 (ref.)
0.1-1.4	396	276,444	0.76 (0.65-0.88)	0.83 (0.72-0.96)
1.5-4.9	268	193,921	0.74 (0.63-0.88)	0.83 (0.70-0.98)
5.0+	62	43,564	0.77 (0.59-1.02)	0.79 (0.60-1.05)
p-trend			0.03	0.09
<i>Spirits</i>				
0	593	382,916	1.00 (ref.)	1.00 (ref.)
0.1-1.4	367	258,610	1.06 (0.91-1.22)	0.98 (0.85-1.13)
1.5-4.9	129	64,102	1.32 (1.08-1.60)	1.09 (0.89-1.33)
5.0+	30	7,667	2.27 (1.56-3.29)	1.52 (1.04-2.22)
p-trend			< 0.0001	0.05

<sup>a</sup> CI=confidence interval

<sup>b</sup> The alcohol-type specific analyses (wine/beer/spirits) in grams of alcohol per day are additionally adjusted for the intake of complementary alcohol types (0, 0.1-1.4, 1.5-4.9, 5.0+ grams/day), e.g. the wine analysis is adjusted for beer and for spirits intakes, while the alcohol-type specific analyses (wine/beer/spirits) in per cent of total alcohol intake are additionally adjusted for the level of total alcohol intake (0, 0.1-1.4, 1.5-4.9, 5.0-9.9, 10.0-14.9, 15+ grams/day).

<sup>c</sup> Adjusted for age (5-year categories), BMI (<18.5, 18.5-24.9, 25.0+ kg/m<sup>2</sup>), energy-adjusted saturated fat intake (quintiles), smoking status (never, past, and current smoking with current intensities of 1-14 cigs/day, 15-24 cigs/day, and 25+ cigs/day), current physical activity (low, intermediate, high), years of education (0-10, 11-13, 14+ years, where ten years of education correspond to completion of compulsory school, 13 years of education correspond to completion of secondary school, and 14 years of education or more correspond to graduate study at university). The alcohol-type specific analyses (wine/beer/spirits) in grams of alcohol per day are additionally adjusted for the intake of complementary alcohol types (0, 0.1-1.4, 1.5-4.9, 5.0+ grams/day), e.g. the wine analysis is adjusted for beer and for spirits intakes.