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Alcohol Intake and Sickness Absence: A Curvilinear Relation

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Little is known about the U-shaped relation between alcohol intake and health beyond findings related to cardiovascular disease. Medically certified sickness absence is a health indicator in which coronary heart disease is only a minor factor. To investigate the relation between alcohol intake and sickness absence, records regarding medically certified sick leaves from all causes were assessed for 4 years (1997–2000) in a cohort of 1,490 male and 4,952 female municipal employees in Finland. Hierarchical Poisson regression, adjusted for self-reported behavioral and biologic risk factors, psychosocial risk factors, and cardiovascular diseases, was used to estimate the rate ratios and their 95% confidence intervals, relating sickness absence to each level of alcohol consumption. For both men and women, a significant curvilinear trend was found between level of average weekly alcohol consumption and sickness absence. The rates of medically certified sickness absence were 1.2-fold higher (95% confidence interval: 1.1, 1.3) for never, former, and heavy drinkers compared with light drinkers. The U-shaped relation between alcohol intake and health is not likely to be explained by confounding due to psychosocial differences or inclusion of former drinkers in the nondrinkers category. Moderate alcohol consumption also may reduce health problems other than cardiovascular disease.

behavior; cardiovascular diseases; health; personality; sick leave; social support

Abbreviation: CI, confidence interval.

Curvilinear, U- or J-shaped relations have been found between alcohol intake and mortality. Typically, abstainers have slightly higher mortality than moderate drinkers, while heavy drinkers have a much higher mortality rate than the former two groups (1). Curvilinearity is almost exclusively due to the decreased death rate from coronary heart disease among drinkers. No clear pattern was discovered in earlier studies on the relation between alcohol intake and other health outcomes, such as sickness absence (2, 3). Sickness absence is important as an indicator of ill health as well as a measure of the use of health services (4). In the United States, the total number of days lost because of sickness absence is estimated to represent 3–7 percent of regularly scheduled workdays (5), signifying a loss of approximately 550 million workdays each year (6). Because coronary heart disease remains a minor factor in sickness absence (7, 8), a linear, rather than curvilinear, association might be expected between alcohol intake and sickness absence.

We studied the association between alcohol intake and medically certified sickness absence in a large employee cohort. We sought to control for psychosocial factors along with demographic and lifestyle factors since such factors have been suspected to explain why moderate drinkers have better health than abstainers (9) and research points to the potential importance of these factors. Poor social networks, lack of social interaction, and hostility have been demonstrated to be associated with sickness absence and mortality (10, 11). In nondrinkers and heavy drinkers, levels of hostility, mental distress, and anxiety are known to be higher and social support lower than in moderate drinkers (12). We also studied the potential confounding role of former drinkers in the relation between alcohol intake and health.

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Many health problems not only cause sickness absence but may also require persons to give up drinking.

MATERIALS AND METHODS

Participants

Data were drawn from the 10 Town Study, an ongoing cohort study exploring the relations between behavioral and psychosocial factors and health in persons from 10 Finnish municipalities (13). In 1997, 6,442 identifiable, full-time, permanent municipal workers (1,490 men and 4,952 women) agreed to participate in the study and responded to a questionnaire inquiring about alcohol intake, health risk behaviors, cardiovascular risk factors or diseases, social support, psychological traits, and self-reported health; the response rate was 67 percent. The sample did not differ from the eligible population—all 24,351 permanent, full-time municipal employees in the towns—in terms of age (mean age of respondents, 46.1 years for men and 44.8 years for women; the corresponding ages of the eligible population were 45.3 years and 45.0 years). The proportion of men (23 percent) and the rate of medically certified sickness absence (per 100 person-years, 61.2 for men and 84.2 for women) were slightly lower in the sample than in the eligible population (28 percent men; absence rate per 100 person-years, 70.4 for men and 89.1 for women). The study was approved by the Ethics Committee of the Finnish Institute of Occupational Health.

Measures

The subjects reported their habitual frequency and amount of beer, wine, and spirits intake. This information was transformed into grams of alcohol per week (14, 15). One unit of pure alcohol (12 g) was equal to a 12-cl glass of wine, a single 4-cl measure of spirits, or a 33-cl bottle of beer. Subjects who reported no alcohol intake (nondrinkers) were divided into former drinkers (if they had ever in their lifetime consumed at least one unit of alcohol) and lifelong abstainers (16). We classified respondents into six categories based on their weekly alcohol intake (never drinkers, former drinkers, 1–50 g, 51–100 g, 101–275 g, and >275 g) (3, 17).

Information relating to all medically certified (>3 days) sickness absences was derived from employers' records from January 1, 1997, to December 31, 2000 (8). These records do not contain any diagnostic information. The mean length of follow-up was 3.5 (standard deviation, 0.9) years, altogether 22,271 person-years. The sickness absence records were checked for inconsistencies. Overlapping or consecutive spells of sickness absence were combined. Employers participating in the 10 Town Study record each sick-leave period of every employee, including the dates on which each spell started and ended. In accordance with regulations, each sick-leave certificate must be forwarded for recording. In Finland, municipal employers receive statutory compensation from the Finnish Social Insurance Institution for loss of salary due to sick leave. To receive the full compensation to which employers are entitled, they are obligated to keep precise records of sick leaves. Employees receive their full salary during sick leave periods beginning on the first day, and medical certificates are always required for sick leaves of more than 3 days, a focus of this study.

Covariates were measured in standard ways. Information on the age at which the respondent started smoking and quit smoking, as well as the number of cigarettes smoked per day, was used to measure pack-years (number of years of smoking × number of cigarettes smoked per day/20). Sedentary lifestyle was indicated by leisure-time physical activity corresponding to less than half an hour of fast walking per week (18). Self-reported weight and height were used to calculate body mass index (kg/m^2) and short stature (<170 cm for men and <160 cm for women). Cardiovascular risk factors and diseases were measured by breathlessness (yes or no) (19) and by self-reported myocardial infarction, angina, cerebrovascular disease, hypertension, diabetes, and high serum cholesterol level, information derived from a checklist of 18 common chronic diseases or conditions diagnosed by a physician (20).

Social network was measured by using the Brief Social Support Questionnaire (21) (six items; range, 1–5) and work-related social support by using a standard survey instrument of Statistics Finland (22). The latter measures social support received from the supervisor (seven items; Cronbach's alpha = 0.91; range, 1–5) as well as from workmates (10 items; Cronbach's alpha = 0.91; range, 1–5). The following psychological traits and states were assessed: optimism (23) (six items; Cronbach's alpha = 0.73; range, 1–4); sense of coherence (24) (13 items; Cronbach's alpha = 0.82; range, 1–13); hostility (20) (three items; Cronbach's alpha = 0.77; range, 1–7); trait anxiety (25) (six items; Cronbach's alpha = 0.84; range, 1–4); and psychological distress (26) (12 items; Cronbach's alpha = 0.89; range, 1–4).

Other predictors of health were age, marital status (single vs. cohabiting), and income. We used employers' records to obtain data on a participant's occupational title, coded in 797 Statistics Finland categories. Average monthly income figures, itemized separately for women and men by occupational title, were received from Statistics Finland (i.e., official Finnish government statistics).

Statistical analyses

Analysis of variance was used to study the associations of continuous variables with level of alcohol consumption; logistic regression was used to analyze the associations of dichotomous variables (marital status, sedentary lifestyle, and short stature) with level of alcohol consumption. All analyses were adjusted for age and income.

Poisson regression models were used to calculate the rate of sickness absences per 100 person-years and the corresponding rate ratios and their 95 percent confidence intervals by level of alcohol consumption, as in our earlier studies (8, 15). We calculated the number of periods of sick leave and the follow-up period in person-years for each employee. In Poisson regression models, sickness absence was first adjusted for demographics. Additional adjustments were made for those behavioral and biologic risk factors, psychosocial risk factors, and cardiovascular diseases significantly associated with alcohol consumption. Use of the Poisson model implies that

TABLE 1. Mean scores* (standard errors) or percentages of demographic, psychosocial, and behavioral and biologic factors, by level of average alcohol consumption† in men, 10 Town Study, Finland, 1997–2000

	Never drinkers (*n* = 21)		Former drinkers (*n* = 81)		1–50 g (*n* = 323)		51–100 g (*n* = 396)		101–275 g (*n* = 467)		>275 g (*n* = 192)		*p* value*
	%	Mean (SE‡)	%	Mean (SE)	%	Mean (SE)	%	Mean (SE)	%	Mean (SE)	%	Mean (SE)	
Demographics													
Age (years)		50.1 (1.8)		48.3 (1.0)		45.6 (0.5)		45.6 (0.4)		45.4 (0.4)		47.4 (0.6)	<0.001
Income (100s of €/month)		20.3 (1.4)		18.0 (0.8)		20.0 (0.4)		21.0 (0.3)		20.6 (0.3)		21.3 (0.5)	0.004
Single vs. cohabiting	14		21		18		15		14		17		0.907
Psychosocial factors													
Social network (no. of roles)		1.73 (0.24)		1.99 (0.13)		2.02 (0.04)		2.06 (0.06)		2.11 (0.05)		2.16 (0.08)	0.413
Co-worker support		3.54 (0.17)		3.40 (0.09)		3.41 (0.05)		3.51 (0.04)		3.31 (0.04)		3.37 (0.06)	0.020
Supervisor support		3.08 (0.20)		3.08 (0.11)		3.03 (0.05)		3.13 (0.05)		3.02 (0.04)		3.03 (0.07)	0.577
Sense of coherence		5.17 (0.18)		4.72 (0.10)		4.87 (0.05)		4.90 (0.04)		4.79 (0.04)		4.79 (0.06)	0.087
Optimism		3.23 (0.10)		3.04 (0.06)		3.05 (0.03)		3.11 (0.02)		3.05 (0.02)		3.06 (0.04)	0.295
Hostility§		0.80 (0.10)		0.85 (0.06)		0.86 (0.03)		0.92 (0.02)		0.95 (0.02)		0.94 (0.04)	0.126
Anxiety		1.93 (0.12)		1.90 (0.06)		1.91 (0.03)		1.93 (0.03)		1.99 (0.02)		2.00 (0.04)	0.144
Psychological distress		1.92 (0.10)		2.08 (0.05)		1.97 (0.03)		1.96 (0.02)		2.05 (0.02)		2.05 (0.03)	0.017
Behavioral and biologic factors													
Smoking (pack-years)		0.2 (2.7)		7.7 (1.5)		5.9 (0.7)		8.0 (0.7)		11.0 (0.6)		11.4 (1.0)	<0.001
Body mass index (kg/m^2)		24.9 (0.7)		25.0 (0.4)		25.8 (0.2)		26.1 (0.2)		26.0 (0.2)		26.6 (0.2)	0.008
Sedentariness vs. nonsedentariness	10		18		15		13		17		22		0.158
Breathlessness (yes vs. no)	14		30		22		26		26		35		0.025
Hypertension (yes vs. no)	29		12		13		14		17		21		0.079
High cholesterol level (yes vs. no)	33		22		20		22		29		33		0.063
Cardiovascular disease (yes vs. no)	14		7		5		5		7		3		0.070
Diabetes (yes vs. no)	0		5		4		3		4		2		0.596
Short stature vs. others	14		10		9		7		8		7		0.844

* Age- and income-adjusted analysis of variance for continuous and logistic regression for dichotomous variables was used.
† Grams of absolute alcohol per week.
‡ SE, standard error.
§ Logarithmic transformation.

the between-employee variance in the rates of sick leave equals the expected rate of sick leave. In this study, the dispersion in medically certified sick leaves did not significantly deviate from the assumptions used for Poisson models.

Next, we studied whether the associations of average level of alcohol consumption depended on beverage type (wine, beer, or spirits) by assessing the independent effects of each type of drink on sickness absence. Finally, the tests for curvilinear trend were performed by adding a quadratic term for alcohol consumption to the models (27). Curvilinearity was tested before and after excluding former drinkers from the nondrinkers category.

The SAS software package (SAS Institute, Inc., Cary, North Carolina) was used to perform all analyses. Poisson regression models were calculated by using the SAS GENMOD procedure.

RESULTS

Of the men in our study, 1.4 percent were never drinkers, 5.5 percent were former drinkers, and 13 percent were heavy drinkers who consumed more than 275 g of alcohol a week. The corresponding figures for women were 3.0 percent, 14.4 percent, and 1.8 percent. Table 1 shows that, compared with light-drinking men (51–100 g alcohol per week), male never and former drinkers were older and had lower incomes, and former drinkers were more psychologically distressed. Heavy-drinking men had higher levels of distress, a higher body mass index, and breathlessness more often, and they smoked more. Heavy drinking was also associated with having one or more of the following health problems: hypertension, increased serum cholesterol levels, or cardiovascular diseases ($p = 0.03$).

For women, the findings were similar to those for men regarding the associations of alcohol intake with age, income, and smoking (table 2). Compared with light-drinking women, female never and former drinkers had smaller social networks and a more sedentary lifestyle, and heavy drinkers had lower levels of supervisory support, a weaker sense of coherence, less optimism, and higher levels of hostility, anxiety, and psychological distress; hypertension was also more frequent.

TABLE 2. Mean scores* (standard errors) or percentages of demographic, psychosocial, and behavioral and biologic factors, by level of average alcohol consumption† in women, 10 Town Study, Finland, 1997–2000

	Never drinkers (*n* = 146)		Former drinkers (*n* = 707)		1–50 g (*n* = 2,514)		51–100 g (*n* = 979)		101–275 g (*n* = 483)		>275 g (*n* = 88)		*p* value*
	%	Mean (SE‡)	%	Mean (SE)	%	Mean (SE)	%	Mean (SE)	%	Mean (SE)	%	Mean (SE)	
Demographics													
Age (years)		49.9 (0.7)		45.3 (0.3)		44.6 (0.2)		44.6 (0.3)		44.4 (0.4)		45.0 (0.9)	<0.001
Income (100s of €/month)		15.6 (0.4)		15.4 (0.2)		16.5 (0.1)		17.1 (0.1)		17.2 (0.2)		17.8 (0.5)	<0.001
Single vs. cohabiting	23		25		22		21		25		23		0.521
Psychosocial factors													
Social network (no. of roles)		2.38 (0.09)		2.44 (0.04)		2.58 (0.02)		2.62 (0.03)		2.64 (0.05)		2.73 (0.12)	<0.001
Co-worker support		3.53 (0.07)		3.58 (0.03)		3.56 (0.02)		3.56 (0.03)		3.48 (0.04)		3.50 (0.09)	0.407
Supervisor support		3.20 (0.08)		3.29 (0.03)		3.22 (0.02)		3.18 (0.03)		3.12 (0.04)		3.03 (0.10)	0.018
Sense of coherence		5.02 (0.07)		4.95 (0.03)		4.92 (0.02)		4.85 (0.03)		4.76 (0.04)		4.58 (0.09)	<0.001
Optimism		3.19 (0.04)		3.11 (0.02)		3.13 (0.01)		3.15 (0.02)		3.09 (0.02)		3.01 (0.05)	0.039
Hostility§		0.82 (0.04)		0.87 (0.02)		0.90 (0.01)		0.91 (0.01)		1.00 (0.02)		1.08 (0.05)	<0.001
Anxiety		1.80 (0.05)		1.89 (0.02)		1.90 (0.01)		1.92 (0.02)		2.01 (0.02)		2.11 (0.06)	<0.001
Psychological distress		1.98 (0.04)		1.99 (0.02)		2.01 (0.01)		2.02 (0.01)		2.08 (0.02)		2.15 (0.05)	0.001
Behavioral and biologic factors													
Smoking (pack-years)		0.34 (0.60)		2.45 (0.28)		2.58 (0.15)		3.48 (0.23)		6.69 (0.34)		8.32 (0.80)	<0.001
Body mass index (kg/m^2)		24.6 (0.4)		25.1 (0.2)		24.8 (0.1)		24.9 (0.1)		25.0 (0.2)		25.6 (0.5)	0.312
Sedentariness vs. nonsedentariness	19		21		15		13		14		14		0.005
Breathlessness (yes vs. no)	40		42		36		35		39		39		0.092
Hypertension (yes vs. no)	19		11		13		13		12		23		0.045
High cholesterol level (yes vs. no)	23		15		15		14		10		18		0.101
Cardiovascular disease (yes vs. no)	6		4		3		4		1		5		0.159
Diabetes (yes vs. no)	3		2		2		1		1		2		0.955
Short stature vs. others	24		21		18		17		18		17		0.518

* Age- and income-adjusted analysis of variance for continuous and logistic regression for dichotomous variables was used.
† Grams of absolute alcohol per week.
‡ SE, standard error.
§ Logarithmic transformation.

Table 3 shows that, compared with the rates for male and female light drinkers, the rates of medically certified sickness absences were 1.2-fold higher (95 percent confidence interval (CI): 1.1, 1.3) for never, former, and heavy drinkers after we adjusted for demographics, behavioral and biologic risk factors, psychosocial risk factors, and cardiovascular diseases. No sex differences were observed. For both men and women, there was a significant curvilinear trend between level of average weekly alcohol consumption and sickness absence, before and after we excluded former drinkers from the nondrinkers category.

As depicted in table 4, the relation between alcohol consumption and sickness absence was dependent on type of alcohol beverage. Nonconsumption of alcohol was associated with increased risk of sickness absence for men and women, but only in relation to wine and beer. For spirits, nonconsumption of alcohol was associated with a decreased risk of sickness absence. After we controlled for intake of other beverage types, demographics, behavioral and biologic risk factors, psychosocial risk factors, and cardiovascular diseases, the association of sickness absence with wine and beer was curvilinear, but with spirits it was linear for both sexes, regardless of whether former drinkers were excluded from the nondrinkers category.

To explore the role of beverage type further, we analyzed in the fully adjusted models three small subsamples consisting of those subjects who consumed no more than one of the three beverage types and nondrinkers. In relation to wine, male (n = 98) and female (n = 843) nondrinkers had 1.42-fold higher (95 percent CI: 1.06, 1.90) and 1.18-fold higher (95 percent CI: 1.11, 1.26), respectively—and, in relation to beer, male (n = 97) nondrinkers had 1.30-fold higher (95 percent CI: 1.04, 1.61)—rates of sickness absence compared with the rates for consumers of wine (35 men, 773 women) and beer (76 men). For male spirits and female beer and spirits drinkers, the corresponding rate ratios were nonsignificant.

TABLE 3. Associations of level of average alcohol consumption* with medically certified sickness absences, expressed as rate ratios and their 95% confidence intervals, relative to light drinkers (51–100 g/week), 10 Town Study, Finland, 1997–2000

	No. of participants	No. of sickness absences	Unadjusted			Demographics† adjusted			Fully adjusted‡		
			Rate ratio	95% confidence interval	*p* for curvilinear trend§	Rate ratio	95% confidence interval	*p* for curvilinear trend§	Rate ratio	95% confidence interval	*p* for curvilinear trend§
						All subjects					
Alcohol consumption					<0.001			<0.001			<0.001
Never drinkers	167	495	1.24	1.13, 1.37		1.07	0.98, 1.18		1.21	1.07, 1.35	
Former drinkers	788	2,648	1.38	1.31, 1.45		1.18	1.12, 1.24		1.21	1.14, 1.28	
1–50 g	2,837	7,820	1.12	1.08, 1.17		1.02	0.98, 1.07		1.07	1.02, 1.11	
51–100 g	1,375	3,433	1.00			1.00			1.00		
101–275 g	950	2,580	1.07	1.02, 1.13		1.12	1.06, 1.18		1.05	0.99, 1.11	
>275 g	280	777	1.09	1.01, 1.17		1.28	1.18, 1.39		1.19	1.09, 1.30	
						Men					
Alcohol consumption					<0.001			<0.001			<0.001
Never drinkers	21	40	0.95	0.69, 1.30		0.97	0.70, 1.33		1.12	0.81, 1.55	
Former drinkers	81	265	1.73	1.51, 1.99		1.53	1.33, 1.71		1.41	1.20, 1.65	
1–50 g	323	646	1.04	0.93, 1.15		0.95	0.85, 1.06		1.02	0.91, 1.14	
51–100 g	396	759	1.00			1.00			1.00		
101–275 g	467	1,100	1.22	1.11, 1.33		1.14	1.04, 1.25		1.10	1.00, 1.22	
>275 g	192	468	1.26	1.12, 1.41		1.30	1.16, 1.46		1.17	1.03, 1.33	
						Women					
Alcohol consumption					<0.001			<0.001			<0.001
Never drinkers	146	455	1.21	1.10, 1.34		1.09	0.98, 1.20		1.22	1.10, 1.36	
Former drinkers	707	2,383	1.27	1.20, 1.34		1.15	1.08, 1.21		1.22	1.15, 1.29	
1–50 g	2,514	7,174	1.07	1.02, 1.11		1.03	0.98, 1.08		1.06	1.01, 1.11	
51–100 g	979	2,674	1.00			1.00			1.00		
101–275 g	483	1,480	1.11	1.04, 1.18		1.11	1.04, 1.18		1.05	0.98, 1.12	
>275 g	88	309	1.24	1.10, 1.39		1.28	1.13, 1.44		1.24	1.10, 1.40	

* Grams of absolute alcohol per week.

† Sex, age, and income.

‡ Adjusted for demographics, behavioral and biologic risk factors, psychosocial risk factors, and cardiovascular diseases.

§ Average consumption of alcohol (grams per week; logarithmic transformation) was used in the analyses. When the nondrinkers category was restricted to lifelong abstainers, the fully adjusted test for curvilinear trend for alcohol was $p = 0.01$ for men and $p = 0.002$ for women.

DISCUSSION

We found a curvilinear, U-shaped relation between alcohol intake and medically certified sickness absence for men and women. Never, former, and heavy drinkers had higher rates of sickness absence compared with light drinkers. For both sexes, curvilinearity was significant even when drinkers were compared with never drinkers instead of all nondrinkers. By type of alcohol beverage, nondrinking was associated with an increased risk of sickness absence in relation to wine and beer only.

To our knowledge, this is the first study to discover a curvilinear relation between alcohol intake and sickness absence. A previous study found that employees consuming 270 g of alcohol or more per week had a higher number of both absence spells and sickness days than those drinking less, with no adjustment made (2). Another study found that male never drinkers and daily drinkers had more short sickness absence spells than those men drinking once or twice a week, after the authors adjusted for age and employment grade (3). No significant relation was revealed between average alcohol intake and absence.

Sickness absence has been considered a good measure of health in the working population when health is understood to be a combination of social, psychological, and physical functioning (4, 7, 8). Recorded sickness absence data contain information on the health problems employees face in their everyday life. Thus, the quality of such data in terms of coverage, accuracy, and consistency over time is likely to be higher than that attainable via self-reports. Since the process of recording sick leave is routine, the impact of measurement on the responses being obtained is minimized.

TABLE 4. Rate ratios and their 95% confidence intervals for medically certified sickness absences, by average consumption of wine, beer, and spirits,* adjusted for demographics, behavioral and biologic risk factors, psychosocial risk factors, and cardiovascular diseases, 10 Town Study, Finland, 1997–2000

Average consumption (g)	Men				Women			
	No. of participants	Rate ratio	95% confidence interval	*p* for curvilinear trend	No. of participants	Rate ratio	95% confidence interval	*p* for curvilinear trend
Wine†				<0.001				<0.001
0	400	1.25	1.14, 1.37		1,504	1.18	1.14, 1.23	
1–50	866	1.00			3,090	1.00		
>50	181	1.15	1.02, 1.31		294	1.08	1.00, 1.17	
Beer†				0.002				0.006
0	224	1.25	1.11, 1.40		2,213	1.09	1.05, 1.13	
1–50	806	1.00			2,394	1.00		
>50	439	1.05	0.96, 1.15		262	1.05	0.97, 1.13	
Spirits‡				0.305				0.174
0	346	0.96	0.86, 1.06		2,953	0.94	0.91, 0.98	
1–50	948	1.00			1,897	1.00		
>50	179	1.14	1.02, 1.28		24	1.24	1.00, 1.53	

* Grams of absolute alcohol per week.

† When the nondrinkers category was restricted to lifelong abstainers from any type of alcohol, the test for curvilinear trend for wine was $p < 0.001$ for both sexes and, for beer, $p = 0.004$ for men and $p = 0.01$ for women.

‡ The test for linear trend for spirits was $p = 0.01$ for men and $p < 0.001$ for women. When the nondrinkers categories was restricted to lifelong abstainers, the corresponding p values were $p = 0.02$ and $p < 0.001$.

The outcome measure in our study, number of sickness absences, has been shown to be more stable and less susceptible to error than other measures of absenteeism (28). Infections, musculoskeletal disorders, and injuries have been found to account for the majority of all medically certified spells of absence in men and women, the proportion of cardiovascular causes being no more than 0.5–4 percent (7, 8). Thus, the diagnostic distribution can differ widely among patients in primary care, those in hospitals, and mortality statistics for the deceased. In spite of these differences, our finding of a curvilinear relation is by and large in line with most studies on alcohol intake, mortality, hospitalization, and hospital admissions (1, 29–31). This result is not surprising when bearing in mind that long sick leaves based on a physician's examination reflect employees' health fairly well and that these absences are associated with other health measures and common predictors of health, such as age and socioeconomic status (4, 8).

Although the possibility of confounding by an unknown factor can never be excluded, a major bias remains unlikely. In addition to major demographic and lifestyle factors, we also had the uncommon opportunity to control for major psychosocial factors. Moreover, we controlled for self-reported hypertension, diabetes, and high cholesterol level. Because our sample of employees had regular health examinations and occupational medical care, we believe these self-reports to be accurate. If some unknown health problems caused certain persons to abstain from alcohol throughout life, then the higher rate of sickness absences among never drinkers would be due to selection rather than the positive effects of moderate drinking. Such selection should operate early in life. Severe illness or mental disorder in early childhood might produce this effect. Because our cohort consisted of workers who had health checkups at the beginning of their career; practically no differences existed between former drinkers and lifelong abstainers in relation to demographic, behavioral, or psychosocial factors; and short stature and several major psychosocial factors were controlled for, it is implausible that such a selection would have biased the present results. Furthermore, the results were replicable after we excluded former drinkers from the nondrinkers category.

Self-reported alcohol intake figures are underestimates (32). The present results may therefore have overestimated the effects of alcohol consumption on sickness absences. However, overestimation was unlikely in the comparisons between light drinkers and never drinkers.

The high rate of medically certified sickness absences among heavy drinkers may be due to a greater incidence of alcohol-induced diseases, a more severe course of these or other diseases, poorer treatment or compliance with it, or inferior functional capacity because of excessive alcohol consumption. Likewise, the higher rate of sickness absences among never drinkers and former drinkers than among light drinkers may result from a lack of the protective effects of alcohol intake. Our findings suggest that light alcohol intake reduces the incidence of not only cardiovascular disease but also other health problems.

Our finding of lower sickness absence rates among light drinkers than among abstainers might be explained by several potentially beneficial effects of moderate alcohol intake. The antiatherogenic effects of moderate alcohol intake are well known. Randomized trials have shown beneficial effects on lipids and hemostatic factors (17). There is some evidence for a protective effect of alcohol on infectious

diseases. At concentrations above 15 percent, alcohol inactivates most vegetative organisms. Intake of beverages containing 10 percent or more alcohol has been found to reduce the risk of an oyster-borne hepatitis A infection (33). When viruses were experimentally introduced into healthy volunteers, moderate alcohol intake was found to protect nonsmokers from clinical symptoms of common cold (34). Evidence suggesting other putative mechanisms has been reviewed elsewhere (35).

The curvilinear pattern was significant with respect to wine and beer drinking; for spirits drinking, an increasing linear trend emerged. The results are similar to those observed with respect to cardiovascular mortality in a Danish cohort (36). However, a recent review of the studies on alcoholic beverage type and risk of coronary heart disease showed that the evidence in favor of wine is not consistent and that the beneficial effect is mainly due to ethyl alcohol (37). The present findings may be explained by differences in drinking patterns. Drinkers of spirits may favor hard, intoxicating drinking, while the patterns of wine and beer drinkers may be more moderate.

In conclusion, the relation between alcohol intake and recorded sickness absence, including an element of physician judgment, appears curvilinear. This relation does not seem to be explained by confounding due to cardiovascular risk factors or diseases, psychosocial differences, or inclusion of former drinkers in the nondrinkers category. The risk of sickness absence tends to be increased by heavy drinking and decreased by moderate consumption. Furthermore, differences seem to prevail between beer, wine, and spirits drinking.

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