Scandinavian Journal of Public Health, 2015; 43: 364–372

ORIGINAL ARTICLE

Changes in alcohol drinking and subsequent sickness absence

AINO SALONSALMI[1], OSSI RAHKONEN[1], EERO LAHELMA[1] & MIKKO LAAKSONEN[1,2]

[1]*Department of Public Health, University of Helsinki, Finland, and* [2]*Finnish Centre for Pensions, Finland*

Abstract

Aims: The aim was to examine whether changes in alcohol drinking are associated with sickness absence. *Methods*: Repeated postal questionnaires on alcohol drinking were conducted among employees of the City of Helsinki in 2000–2 and 2007 to assess changes in drinking habits between these two time points. Data on the number of self-certified and medically confirmed sickness absences were derived from the employer's register. Sickness absences were followed from 2007 until the end of 2010 among employees participating in both questionnaire surveys. The study includes 3252 female and 682 male employees 40–60 years old at baseline. Poisson regression was used in the data analysis and population attributable fractions (PAFs) were calculated. *Results*: Alcohol drinking was associated especially with self-certified sickness absence. Rate ratios (RRs) and 95% confidence intervals (CIs) for increasing weekly average drinking were 1.38, 1.18–1.62 among women and 1.58, 1.18–2.12 among men. Also stable problem drinking (for women 1.39, 1.26–1.54, for men 1.44, 1.10–1.87) and among women stable heavy drinking (1.53, 1.20–1.94) increased self-certified sickness absence. There were associations between alcohol drinking and medically confirmed sickness absence but these were mainly explained by health and health behaviours. Also, a decrease in weekly average drinking was associated with sickness absence among women whereas among men former problem drinking increased sickness absence. According to the PAF values, problem drinking had a stronger contribution to sickness absence than weekly average drinking. ***Conclusions*: Alcohol drinking is particularly associated with self-certified sickness absence. Reducing adverse drinking habits is likely to prevent sickness absence.**

Key Words: *alcohol drinking, drinking habit, sickness absence, longitudinal studies, employee health*

Introduction

Excessive alcohol drinking is a major but preventable threat to employee health and work ability. Drinking has been associated with reduced work performance [1], work accidents [2], sickness absence [3–10] and disability retirement [4]. Alcohol consumption has been increasing in Finland almost continuously since the 1960s and also elderly people have increased their drinking [11]. Increasing drinking might be especially damaging to elderly employees as higher age itself contributes to susceptibility to adverse effects of drinking [12]. Reducing alcohol intake might lead to better health [13]. However, there is a lack of previous studies on changes in alcohol drinking among elderly employees and their contribution to work ability.

Sickness absence is granted when an employee is temporarily unable to do the normal work tasks because of ill health. Population-level studies from Sweden [6] and Norway [10] have found that alcohol consumption is associated with increased sickness absence among men but not among women. A Finnish study with repeated individual-level cross-sectional data also found an association among women; however, the association was particularly pronounced among men with a low level of education [8]. Individual-level studies have also found both heavy drinkers and non-drinkers to have excess sickness absence compared with moderate drinkers [3–5,9]. Here associations have also been

Correspondence: Aino Salonsalmi, Department of Public Health, University of Helsinki, PO Box 41 (Mannerheimintie 172), 00014, Finland. E-mail: aino.salonsalmi@helsinki.fi

(Accepted 27 January 2015)

DOI: 10.1177/1403494815574154

found more often among men. When examining alcohol drinking and sickness absence it is important to separate self-certified and medically confirmed sickness absence spells as they may partly affect work disability in different ways. In particular, medically certified sickness absence is regarded as a valid measure of health [14] and it may better reflect alcohol-related diseases, whereas self-certified sickness absence may also picture immediate effects of heavy drinking episodes *per se*. In previous studies heavy drinking has been associated with both self-certified and medically confirmed sickness absence. In addition to the amount of alcohol consumed, associations between problem drinking and sickness absence have also been studied. A Swedish study found an association among men only [4] whereas our previous Finnish study found an association with both self-certified and medically confirmed sickness absence among both women and men [9].

Alcohol drinking is a modifiable risk factor for employee health and thus examining changes in drinking habits is important and provides evidence for prevention of adverse consequences such as sickness absence. However, there are no previous studies about changes in drinking habits and sickness absence. One study examined changes in drinking and future disability retirement, finding no associations [15]. The measurements were made 25 years apart and the indicator of drinking only distinguished between stable abstainers and others. Studies on the consequences of long-term drinking habits and their changes over time have also shown that stable moderate drinking is most beneficial for self-perceived health, general health, diabetes mellitus type 2, ischaemic heart disease and mortality [16–18]. A study on changes in drinking habits found that stable moderate drinkers had the best health whereas non-drinkers and those who had quit or started drinking reported a decline in health [17]. In the light of these previous studies, stable moderate drinking is likely to be associated with the lowest sickness absence rates as well. Stable heavy drinking and problem drinking are expected to be associated with the highest levels of sickness absence, whereas decreasing drinking might be associated with lower levels. However, the opposite associations are also possible if decreasing drinking is due to ill health.

The aim of this study was to examine changes over time in weekly average drinking and problem drinking and their associations with self-certified and medically confirmed sickness absence among middle-aged municipal employees. As both sickness absence behaviours and drinking habits differ between women and men genders are analysed separately.

Data and methods

The study is part of the Helsinki Health Study on middle-aged employees of the City of Helsinki [19]. The baseline survey data were collected by postal questionnaires among all the employees of the City of Helsinki reaching 40, 45, 50, 55 or 60 years in 2000, 2001 and 2002. The participants of this first survey are referred to as baseline respondents throughout this paper. The sample was 13,346 employees and 8960 participated, yielding a response rate of 67% . The majority of the participants (80%) were women, which corresponds to the female majority in Finnish municipal sector.

A follow-up survey was conducted in 2007. The baseline participants were asked identical questions at the follow-up. A total of 7332 persons participated and the response rate was 83%. Those who did not participate at follow-up were excluded. Among 3517 female and 720 male participants who gave their informed consent the questionnaire data were linked with data on sickness absence received from the employer's register. After exclusions due to being pregnant at baseline (n=10), missing data on covariates (n=242) or having no workdays after beginning the follow-up of sickness absence (n=51), 3252 women and 682 men were included. There was item non-response on the questions about drinking habits and thus the final analyses include slightly fewer participants (see Table II).

Non-response analyses of the Helsinki Health Study have shown that non-participation or consenting to data linkages did not cause serious bias although men, younger employees and those with lower socioeconomic position and those with many medically confirmed sickness absence spells were less likely to participate (19).

The Ethics Committee of the Department of Public Health at the University of Helsinki and the Ethics Committee of the health authorities at the City of Helsinki approved the study.

Sickness absence

The data on sickness absence spells, their date and duration were received from the personnel register of the City of Helsinki. Overlapping and consecutive sickness absence spells were combined. The sickness absence spells were divided into self-certified (1–3 days) and medically confirmed (4 days or over) spells as the City of Helsinki requires a medical certificate of sickness absence spells exceeding 3 days. Medical confirmation means that the employee must provide the employer with a medical certificate including a diagnosis and an assessment of work ability. This is done by medical professionals during a medical

appointment. Without medical confirmation the employee risks a financial penalty during the sickness. The follow-up of sickness absence began from the day of receiving the follow-up questionnaire and continued until the end of 2010. The mean follow-up time was 2.8 years.

Drinking variables

The baseline and follow-up questionnaires included identical questions about drinking habits. There were questions on the weekly average use of beer or cider, the weekly average use of wine or other mild beverages and on the monthly average use of spirits. From these data we calculated the weekly average drinking of alcohol at baseline and at follow-up. Participants were divided to non-drinkers, moderate drinkers and heavy drinkers both at baseline and at follow-up. Drinking 0 units per week was defined as non-drinking and drinking 1 to 15 units per week as moderate drinking. Drinking 16 units or over per week was defined as heavy drinking. A total of 16 units or more per week is often referred to as the limit of heavy drinking for women in Finland and the majority of participants were women. Non-drinkers, moderate drinkers or heavy drinkers both at baseline and at follow-up were classified as non-drinkers, moderate drinkers and heavy drinkers, respectively. Those moving from non-drinking group to moderate or heavy-drinking group formed a group named 'more' in a five-class change variable and those moving from heavy or moderate groups to moderate and non-drinking groups formed a less drinking group.

Problem drinking was measured by the CAGE-questionnaire [20] including four items: Have you ever thought about Cutting down your drinking? Have you ever been Annoyed because of criticism about your drinking? Have you ever felt Guilty because of your drinking? Have you needed an Eye-opener? A positive answer to each item adds 1 point to a summary score ranging from 0 to 4. The cut-off for problem drinking was set to 2 points for women and to 3 points for men [21]. The CAGE scale measures lifetime problem drinking. However, a significant number of the respondents reported to be problem drinkers at baseline but not at follow-up and we chose to examine them separately and called them former problem drinkers. The other groups were never, new and stable problem drinkers.

Table 1. Drinking habits at baseline and at follow-up among 3252 women and 682 men participants.

	Women				Men			
	Baseline		Follow-up		Baseline		Follow-up	
	n	%	*n*	%	*n*	%	*n*	%
Weekly average consumption								
Non-drinking	174	5	223	7	30	4	39	6
Moderate	2953	92	2850	88	521	77	484	71
Heavy	95	3	149	5	129	19	157	23
Mean number of drinks per week	4.1		4.5		9.5		10.6	
Problem drinking								
No	2588	83	2451	79	514	77	513	77
Yes	534	17	671	21	154	23	155	23

Table II. Changes in drinking habits and number of self-certified and medically confirmed sickness absence spells per 100 person-years.

	Women				Men			
	n	%	Self-certified spells/100 person-years (*n*)	Medically confirmed spells/100 person-years (*n*)	*n*	%	Self-certified spells/100 person-years (*n*)	Medically confirmed spells/100 person-years (*n*)
Weekly average consumption								
No	128	4	163	95	25	4	146	77
Less	135	4	191	116	50	7	127	67
Moderate	2764	86	163	81	444	65	92	47
More	141	4	224	110	70	10	152	57
Heavy	54	2	243	110	91	13	113	57
All	3222	100			680	100		
Problem drinking								
Never	2317	74	156	82	461	69	87	45
Former	134	4	170	90	52	8	148	76
New	271	9	186	83	53	8	177	57
Stable	400	13	221	95	102	15	125	63
All	3122	100			668	100		

Covariates

Covariates were measured at follow-up in 2007 except for health variables for which we assessed change from 2000–2 to 2007. Marital status was classified as never married, married or cohabiting and divorced or widowed. Socioeconomic position was measured by occupational class including four categories: managers and professionals, semi-professionals, routine non-manuals and manual workers. Physical and mental working conditions were both measured by a single-item question inquiring how physically and mentally strenuous the respondent regarded the work. Body mass index was divided into three groups: under 25, between 25 and 30 and above 30 kg/m^2. Physical activity was measured by four questions, from which metabolic equivalent tasks (MET) were calculated. Having fewer than 14 MET hours per week was classified as being inactive, others as active (22). Smoking was classified as current smoking and non-smoking. Body mass index, physical activity and smoking are referred to as health behaviours in this paper. Poor health status was measured by limiting long-standing illness and three or more scores on the General Health Questionnaire (GHQ) 12-item version. Variables describing changes in health from 2000–2 to 2007 were formed from both variables respectively: stable good, improved, deteriorated and stable poor health status.

Statistical methods

First we calculated the rates of self-certified and medically confirmed sickness absence spells per 100 person-years for each of the drinking categories. Models for sickness absence by measures of alcohol drinking were fitted using Poisson regression analysis. The numbers of self-certified and medically confirmed sickness absence spells during the follow-up time were the outcome measures. Moderate drinkers and never-problem drinkers served as reference categories. The results are presented as rate ratios (RRs) and their 95% confidence intervals (CIs). The models showed over-dispersion and thus a scale parameter obtained by dividing the residual deviance by the degrees of freedom was added. Different follow-up time of sickness absence between the participants was taken into account by including follow-up time as an offset variable. First we fitted base models adjusted for age and marital status. Then occupational class and working conditions were added to the base models; next health behaviours and health were added to the base models. Finally the models were adjusted for all the covariates simultaneously. To further analyse the significance of alcohol drinking to sickness absence we calculated population attributable fractions (PAFs) using the Hanley formula [23]. PAF values portray the proportion of sickness absence that could be avoided if all respondents drank as much as those with least sickness absence other factors remaining equal. The analyses were made with SAS statistical package.

Results

The vast majority were moderate drinkers at baseline and at follow-up (Table I). Among both women and men the number of non-drinkers as well as heavy drinkers increased during the follow-up. Among women the mean consumption per week was 4.1 alcohol units at baseline and 4.5 units at follow-up. Among men the corresponding figures were 9.5 units and 10.6 units. The prevalence of problem drinking among women increased whereas among men it remained the same. The distributions of drinking habits by covariates are presented in Tables 1B and 1C in the online Supporting information.

Considering the change, the majority of women and men were stable moderate drinkers (Table II). Men more often than women increased or decreased their weekly average drinking. There were also more heavy drinkers among men. Of women, 13% were stable problem drinkers and 9% had turned into problem drinkers. Among men the corresponding figures were 15% and 8%. Of men 8% were former problem drinkers. Women had more sickness absence spells than men and there were more self-certified sickness absence spells than medically confirmed spells.

Both more and stable heavy drinking women had a higher rate of self-certified sickness absence than stable moderate drinkers even after adjustments (Table III). The risk of non-drinkers was not elevated. In the base model adjusted for age and marital status also less drinking was associated with self-certified sickness absence but the association disappeared after further adjustments for socioeconomic position, working conditions and health and health behaviours. Also, stable problem drinking was associated with self-certified sickness absence. The association between new problem drinking and self-certified sickness absence was borderline significant. The associations between changes in both weekly average drinking and problem drinking and self-certified sickness absence among women mainly remained after adjusting for covariates, although adjusting for health and health behaviours attenuated the associations. Concerning weekly average drinking, the PAF values were small reflecting the dominance of moderate drinkers. According to the PAF values, stable problem drinking contributed most to self-certified sickness absence.

Table III. Changes in drinking habits and self-certified sickness absence among women and men. Rate ratios (95% confidence intervals) and population attributable fractions (PAF*).

	Women				PAF	Men				PAF
	Base model adjusted for age and marital status	Base model + socioeconomic position + working conditions	Base model + health behaviours + health	Fully adjusted model		Base model adjusted for age and marital status	Base model + socioeconomic position + working conditions	Base model + health behaviours + health	Fully adjusted model	
Weekly average consumption										
No	1.00 (0.83–1.21)	0.99 (0.82–1.20)	0.97 (0.81–1.17)	0.97 (0.81–1.16)	0.0	1.59 (0.99–2.55)	1.52 (0.96–2.42)	1.51 (0.97–2.35)	1.46 (0.94–2.27)	1.9
Less	1.21 (1.02–1.43)	1.19 (1.00–1.41)	1.14 (0.97–1.34)	1.13 (0.96–1.33)	0.9	1.35 (0.94–1.94)	1.32 (0.93–1.87)	1.33 (0.95–1.87)	1.31 (0.93–1.83)	2.3
Moderate	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	
More	1.38 (1.18–1.62)	1.39 (1.19–1.63)	1.24 (1.07–1.44)	1.26 (1.09–1.47)	1.6	1.58 (1.18–2.12)	1.45 (1.08–1.94)	1.47 (1.12–1.93)	1.43 (1.09–1.88)	5.2
Heavy	1.53 (1.20–1.94)	1.57 (1.23–2.00)	1.36 (1.08–1.71)	1.39 (1.11 -1.75)	0.9	1.26 (0.94–1.69)	1.17 (0.87–1.57)	1.06 (0.80–1.40)	1.04 (0.78–1.38)	3.0
Problem drinking										
Never	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Former	1.08 (0.90–1.30)	1.09 (0.91–1.31)	1.01 (0.85–1.20)	1.01 (0.85–1.20)	0.3	1.59 (1.14–2.23)	1.49 (1.06–2.08)	1.51 (1.10–2.07)	1.47 (1.07–2.03)	3.9
New	1.13 (0.99–1.29)	1.15 (1.01–1.30)	1.09 (0.97–1.24)	1.11 (0.98–1.25)	1.1	2.04 (1.51–2.77)	1.86 (1.37–2.54)	1.69 (1.26–2.27)	1.62 (1.20–2.19)	6.9
Stable	1.39 (1.26–1.54)	1.41 (1.27–1.57)	1.27 (1.15–1.40)	1.29 (1.17–1.43)	4.7	1.44 (1.10–1.87)	1.32 (1.02–1.72)	1.29 (1.01–1.65)	1.26 (0.98–1.62)	5.6

* PAF values calculated from base models adjusted for age and marital status.

Non-drinking, decreased drinking or heavy drinking was not associated with an increased level of self-certified sickness absence among men (Table III). However, increasers had elevated risk for self-certified sickness absence even after all adjustments. Stable problem drinking and former problem drinking increased the rate of self-certified sickness absence, but the risk for new problem drinkers was even stronger. Judging from the PAF values, both weekly average drinking and problem drinking contributed to self-certified sickness absence.

Heavy average drinking increased the rate of medically confirmed sickness absence among women, but adjusting for health and health behaviours explained the association (Table IV). Also, increasing and decreasing weekly average drinking were associated with medically confirmed sickness absence and these associations also remained in the fully adjusted models. Stable problem drinking increased the rate of medically confirmed sickness absence. Adjusting for health and health behaviours also explained this association. The contribution of drinking habits to medically confirmed sickness absence was however small among women according to the PAF values.

Among men, changes in weekly average drinking were not associated with medically confirmed sickness absence (Table IV). Stable problem drinking and also former problem drinking increased medically confirmed sickness absence, although adjusting for covariates explained the associations. Also, according to the PAF values problem drinking contributed to medically confirmed sickness absence among men.

Discussion

We aimed to examine associations between changes in weekly average and problem drinking and subsequent sickness absence among ageing municipal employees. Increasing weekly average drinking was associated with self-certified sickness absence among both women and men and also among women with medically confirmed sickness absence. Heavy weekly average drinking increased both self-certified and medically confirmed sickness absence among women. Stable problem drinking was associated with both self-certified and medically confirmed sickness absence among both women and men, and among men new problem drinking increased self-certified sickness absence. The associations were stronger for self-certified than for medically confirmed sickness absence; in particular, adjusting for health behaviours and health explained the associations of heavy drinking, increasing drinking and stable problem drinking with medically confirmed sickness absence. Also,

Table IV. Changes in drinking habits and medically confirmed sickness absence among women and men. Rate ratios (95% confidence intervals) and population attributable fractions (PAF*).

	Women				PAF	Men				PAF
	Base model adjusted for age and marital status	Base model + socioeconomic position + working conditions	Base model + health behaviours + health	Fully adjusted model		Base model adjusted for age and marital status	Base model + socioeconomic position + working conditions	Base model + health behaviours + health	Fully adjusted model	
Weekly average consumption										
No	1.16 (0.93–1.45)	1.06 (0.86–1.30)	1.09 (0.89–1.33)	1.01 (0.84–1.23)	0.6	1.59 (0.93–2.73)	1.44 (0.88–2.36)	1.55 (0.98–2.42)	1.47 (0.95–2.27)	2.0
Less	1.47 (1.20–1.79)	1.32 (1.09–1.58)	1.32 (1.11–1.58)	1.24 (1.05–1.47)	1.9	1.34 (0.89–2.02)	1.37 (0.94–1.99)	1.40 (0.99–1.99)	1.37 (0.98–1.91)	2.3
Moderate	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	
More	1.37 (1.12–1.68)	1.37 (1.14–1.65)	1.17 (0.97–1.40)	1.22 (1.02–1.45)	1.6	1.21 (0.83–1.78)	1.15 (0.81–1.64)	1.11 (0.80–1.53)	1.11 (0.81–1.51)	2.0
Heavy	1.39 (1.01–1.92)	1.50 (1.11–2.02)	1.15 (0.86–1.54)	1.24 (0.94–1.64)	0.6	1.22 (0.86–1.73)	1.25 (0.91–1.73)	1.03 (0.77–1.39)	1.13 (0.85–1.51)	2.7
Problem drinking										
Never	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Former	1.10 (0.88–1.38)	1.14 (0.93–1.41)	0.99 (0.81–1.21)	1.03 (0.85–1.25)	0.4	1.63 (1.09–2.43)	1.40 (0.97–2.01)	1.52 (1.09–2.12)	1.38 (1.00–1.91)	4.3
New	1.00 (0.84–1.19)	1.03 (0.88–1.20)	0.94 (0.80–1.10)	0.96 (0.83–1.12)	0.0	1.31 (0.85–2.02)	1.27 (0.86–1.88)	1.07 (0.75–1.53)	1.08 (0.76–1.53)	2.2
Stable	1.17 (1.02 -1.34)	1.25 (1.10–1.42)	1.00 (0.88–1.14)	1.09 (0.97–1.23)	2.1	1.41 (1.03–1.93)	1.24 (0.94–1.65)	1.20 (0.92–1.56)	1.14 (0.89–1.47)	5.4

* PAF values calculated from base models adjusted for age and marital status.

decreasing weekly average drinking among women and former problem drinking among men were associated with increased sickness absence. According to the PAF values, problem drinking had a greater contribution to sickness absence than weekly average drinking.

The studied employees drank relatively modestly on average and no major changes were found in drinking habits although non-drinking and heavy weekly drinking slightly increased. Also, problem drinking among women somewhat increased. The moderate level of consumption and small changes in drinking habits are understandable as the study population was mainly female, permanently employed and had also agreed to respond to and consent to data linkage, which might be less likely among heavy drinkers. Previous studies have suggested that drinking habits tend to be quite stable [24] and that growing older is associated with decreased drinking [25–26], although recent studies have challenged this finding [11,25]. It might be that those with most adverse drinking habits had retired, died or had chosen not to participate in the follow-up for other reasons. To control for this, we compared the distributions of drinking habits between all respondents participating in the baseline survey in 2000–2 and the participants of this study. The drinking habits at baseline were largely similar, with non-drinking being somewhat more common among all baseline respondents than among the participants of this study (data not shown).

In our study, in addition to stable heavy and stable problem drinking, new problem drinking and an increase in weekly average drinking increased self-certified sickness absence, suggesting that self-certified sickness absence also indicates early-onset of the consequences of drinking. A previous study on the day-to-day association of drinking and sickness absence found that employees were more likely to be absent from work the day after consuming alcohol [27] and a Finnish study found that there was a weak tendency of 1-day sickness absences to accumulate near weekends [28]. These results suggest that in addition to ill health, excess self-certified sickness absence might be partly due to recovering from drinking episodes. In an Australian study, 3.5% of the studied employees reported missing at least one work day because of alcohol use in the 3 months prior to the survey [7]. The study also examined self-reported sickness absence due to any illness, and alcohol drinking was associated with an increased level of all-cause sickness absence in addition to alcohol-related sickness absence.

Among women, a decrease in weekly average consumption and among men a former problem drinking increased self-certified sickness absence. These

associations might be due to cutting down because of health reasons, and, in line with this, adjusting for health and health behaviours attenuated the association between a decrease in weekly average drinking and self-certified sickness absence. However, the association of former problem drinking and self-certified sickness absence remained, even after all adjustments. Categorizing former problem drinking is however complicated as the CAGE scale measures lifetime problem drinking [20]. Former problem drinkers might have a problem drinking history but not be adverse drinkers during the follow-up survey. Misinterpretation of the questionnaire is also possible and might bias the results.

Concerning medically confirmed sickness absence, we found somewhat fewer associations, and the associations found were mostly explained by the covariates. Stable problem drinking and among women also stable heavy drinking were associated with an increase in sickness absence. These associations were explained by health behaviours and health, suggesting that an increase in medically confirmed sickness absence was because of the drinkers' ill health. Among women, increasing weekly average drinking was associated with medically confirmed sickness absence, and adjusting for health behaviours and health also attenuated this association. Becoming a problem drinker during the follow-up period was not associated with medically confirmed sickness absence, suggesting that only prolonged drinking serious in nature leads to increasing medically confirmed sickness absence.

Male former problem drinkers had elevated levels of medically confirmed sickness absence. Also, women who had decreased their weekly average drinking had excess medically confirmed sickness absence. Adjusting for health and health behaviours attenuated these associations, suggesting that the reason might be health problems among the reducers. Nevertheless, former problem drinking among women was not associated with either increased medically confirmed or self-certified sickness absence. It might be that decreasing adverse drinking habits contributed to restored health and work ability and a former problem drinking was therefore not associated with sickness absence.

Previous studies, including our own study using the baseline survey data collected in 2000–2 linked to register data for subsequent sickness absence, have found that both non-drinkers and heavy drinkers have more sickness absence than moderate drinkers [3–5,9]. No clear explanation for this finding has been established, and it has been hypothesized that there are previous heavy drinkers [29] and people abstaining due to health reasons in the non-drinker category [30], or drinking might have health benefits [16–18]. It is thus worth mentioning that in the present study stable non-drinkers did not have an elevated level of sickness absence, although among men the point estimates were elevated. This suggests that an increased rate of sickness absence among non-drinkers might be rather due to selection than the health benefits of moderate drinking. Our results are therefore not fully in line with previous studies on alcohol drinking and sickness absence, or studies on changes in drinking habits and health with self-rated health [17], general health [18], ischaemic heart disease [16] and mortality [16] as outcomes that suggest stable moderate drinkers to have the best health. Also, an Australian study did not find any association between non-drinking and sickness absence. The study, however, differed from others by using self-reports about sickness absence during the 3 months prior to the survey [7].

Compared with previous studies on drinking and sickness absence, a major advantage of this study was the possibility to examine associations between changes in drinking habits and sickness absence using a prospective design. However, we could not determine the timing of the changes in drinking habits between the two measurement points. Further strengths of our study include the use of different measures of drinking habits and reliable, register-based sickness absence data practically without drop-out. The study included a relatively small number of men, and men were somewhat less likely to participate, which limited the statistical power of the analysis among men. A major limitation was drop-out, which occurred mainly at baseline in 2000–2 and in consenting to register linkage. To estimate the effects of the drop-out rate, we checked the distributions of drinking habits at baseline among all the participants in the baseline data collection and the participants in this study. Although there were no major differences in the distributions, a healthy worker effect may have diluted the results as the study population was reduced due to non-response, deaths, retirement and termination of work contract during the follow-up. Having many medically confirmed sickness absences was associated with lower study participation, which might have further biased the results. However, we found associations between drinking habits and sickness absence in this modestly drinking study population selected by twice agreeing to answer questionnaires and consenting to data linkage to sickness absence records. The true associations might be stronger than those reported in this study. We expected the associations between alcohol drinking and medically certified sickness absence to be at least as strong as for self-certified sickness absence. It might be that instead

of the association being in fact stronger for self-certified sickness absence, the selection by health status may play a role. Selection by health status might be stronger for medically confirmed sickness absence than for self-certified sickness absence as medically confirmed sickness absence in particular has been found to be associated with poor health status. According to the PAF values, problem drinking had a stronger contribution to sickness absence than weekly average drinking. The PAF values were rather small, but this is partly due to the moderately drinking group being so large.

To summarize, alcohol drinking was particularly associated with self-certified sickness absence. Stable problem drinking and, in addition, among women stable heavy drinking also increased medically certified sickness absence but the associations were mainly attenuated after adjusting for covariates. Both increasing and decreasing drinkers were at increased risk for self-certified and medically confirmed sickness absence, probably reflecting that changes in health status were behind changes in drinking habits. Both weekly average drinking and problem drinking were associated with sickness absence, but the contribution of problem drinking to the burden of sickness absence was stronger. In this study changes in alcohol drinking were analysed, which is causally advantageous compared with cross-sectional data. Changes in drinking habits are important contributors to employee health, which provides evidence for prevention of adverse consequences of alcohol drinking. Preventing adverse drinking habits among employees is likely to support health and work ability and help reduce sickness absence.

Conflict of interest

None declared.

Funding

This research was supported by the Finnish Foundation for Alcohol Studies, the Juho Vainio Foundation, the Signe and Ane Gyllenberg Foundation, the Yrjö Jahnsson Foundation, Academy of Finland (#1129225, #1257362) and the Finnish Work Environment Fund (106065).

References

[1] Mangione TW, Howland J, Amick B, et al. Employee drinking practices and work performance. *J Stud Alcohol* 1999;60:261–70.

[2] Ragland DR, Krause N, Greiner BA, et al. Alcohol consumption and incidence of workers' compensation claims: A 5-year prospective study of urban transit operators. *Alcohol Clin Exp Res* 2002;26:1388–94.

[3] Marmot MG, North F, Feeney A, et al. Alcohol consumption and sickness absence: From the Whitehall II study. *Addiction* 1993;88:369–82.

[4] Upmark M, Moller J and Romelsjo A. Longitudinal, population-based study of self reported alcohol habits, high levels of sickness absence, and disability pensions. *J Epidemiol Community Health* 1999;53:223–9.

[5] Vahtera J, Poikolainen K, Kivimäki M, et al. Alcohol intake and sickness absence: A curvilinear relation. *Am J Epidemiol* 2002;156:969–76.

[6] Norström T. Per capita alcohol consumption and sickness absence. *Addiction* 2006;101:1421–7.

[7] Roche AM, Pidd K, Berry JG, et al. Worker's drinking patterns: The impact on absenteeism in the Australian workplace. *Addiction* 2008;103:738–48.

[8] Johansson E, Böckerman P and Uutela A. Alcohol consumption and sickness absence: Evidence from microdata. *Eur J Public Health* 2008;19:19–22.

[9] Salonsalmi A, Laaksonen M, Rahkonen O, et al. Drinking habits and sickness absence: The contribution of working conditions. *Scand J Public Health* 2009;37:846–54.

[10] Norstöm T and Moan IS. Per capita alcohol consumption and sickness absence in Norway. *Eur J Public Health* 2009;19:383–8.

[11] Mäkelä P, Mustonen H and Tigerstedt C. The Finnish drinking culture. Change and continuity in the past 40 years. *Drug Alcohol Rev* 2012;31:831–40.

[12] Dufour M and Fuller RK. Alcohol in the elderly. *Ann Rev Med* 1995;46:123–32.

[13] Norström T and Ramstedt M. Mortality and population drinking: A review of the literature. *Drug Alcohol Rev* 2005;24:537–47.

[14] Laaksonen M, Kääriä S-M, Leino-Arjas P, et al. Different domains of health functioning as predictors of sickness absence – A prospective cohort study. *Scand J Work Environ Health* 2011;37:213–8.

[15] Ropponen A, Narusyte J, Alexanderson K, et al. Stability and change in health behaviours as predictors for disability pension: A prospective cohort study of Swedish twins. *BMC Public Health* 2011;11:678.

[16] Lazarus NB, Kaplan GA, Cohen RD, et al. Change in alcohol consumption and risk of death from all causes and from ischaemic heart disease. *BMJ* 1991;303:553–6.

[17] Eigenbrodt ML, Fuchs FD, Couper DJ, et al. Changing drinking pattern does not influence health perception: A longitudinal study of the atherosclerosis risk in communities study. *J Epidemiol Community Health* 2006;60:345–50.

[18] Powers JR and Young AF. Longitudinal analysis of alcohol consumption and health of middle-aged women in Australia. *Addiction* 2008;103:424–32.

[19] Lahelma E, Aittomäki A, Laaksonen M, et al. Cohort Profile: The Helsinki Health Study. *Int J Epidemiol* 2013;42:722–30.

[20] Mayfield D, McLeod G and Hall P. The CAGE questionnaire: Validation of a new alcoholism screening instrument. *Am J Psych*; 131:1121–3.

[21] Seppä K, Mäkelä R and Sillanaukee P. Effectiveness of the alcohol use disorders identification test in occupational health screenings. *Alcohol Clin Exp Res* 1995;19:999–1003.

[22] Lahti J, Laaksonen M, Lahelma E, et al. The impact of physical activity on sickness absence. *Scand J Med Sci Sports* 2010;20:191–9.

[23] Hanley JA. A heuristic approach to the formulas for population attributable fraction. *J Epidemiol Community Health* 2001;55:508–14.

[24] Bobo JK, Greek AA, Klepinger DH, et al. Alcohol use trajectories in two cohorts of U.S. women aged 50 to 65 at baseline. *J Am Geriatr Soc* 2010;58:2375–80.

[25] Platt A, Sloan FA and Costanzo P. Alcohol-consumption trajectories and associated characteristics among adults older than age 50. *J Stud Alcohol Drugs* 2010;71:169–79.
[26] Molander RC, Yonker JA and Krahn DD. Age-related changes in drinking pattern from mid- to older age: Results from the Wisconsin Longitudinal Study. *Alcohol Clin Exp Res* 2010;34:1182–92.
[27] McFarlin SK and Fals-Stewart W. Workplace absenteeism and alcohol use: A sequential analysis. *Psychol Addict Behav* 2002;16:17–21.
[28] Vahtera J, Kivimäki M and Pentti J. The role of extended weekends in sickness absenteeism. *Occup Environ Med* 2001;58:818–22.
[29] Saarni SI, Joutsenniemi K, Koskinen S, et al. Alcohol consumption, abstaining, health utility, and quality of life – A general population survey in Finland. *Alcohol Alcohol* 2008;43:376–86.
[30] Green CA and Polen MR. The health and health behaviors of people who do not drink alcohol. *Am J Prev Med* 2001;21:298–305.