Changes in drinking as predictors of changes in sickness absence: A case-crossover study

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ABSTRACT

Background: We investigated whether changes in alcohol use predict changes in the risk of sickness absence in a case-crossover design.

Methods: Finnish public sector employees were surveyed in 2000, 2004, and 2008 on alcohol use and covariates. Heavy drinking was defined as either a weekly intake that exceeded recommendations (12 units for women; 23 for men) or having an extreme drinking session. The responses were linked to national sickness absence registers. We analyzed the within-person relative risk of change in the risk of sickness absence in relation to change in drinking. Case period refers to being sickness absent within one year of the survey and control period refers to not being sickness absent within one year of the survey.

Results: Periods of heavy drinking were associated with increased odds of self-certified short-term (1-3 days) sickness absence (multivariable-adjusted odds ratio [OR] 1.21, 95% CI 1.07-1.38 for all participants; 1.62, 95% CI 1.19-2.21 for men and 1.15, 95% CI 1.00-1.33 for women). A higher risk of short-term sickness absence was also observed after increase in drinking (OR=1.27, 95% CI 1.07-1.52) and a lower risk was observed after decrease in drinking (OR=0.83, 95% CI 0.69-1.00). Both increase (OR=1.38, 95% CI 1.21-1.57) and decrease (OR=1.27, 95% CI 1.19-1.43) in drinking were associated with increased risk of long-term (>9 days) medically certified all-cause sickness absence.

Conclusion: Increase in drinking was related to increases in short- and long-term sickness absences. Men and employees with a low socioeconomic position in particular seemed to be at risk.

Key words: Alcohol intake; case-crossover design; Finland; injury; mental health; poisoning; occupational position; sex differences; sickness absence; socioeconomic gradient

What is already known on this subject?

Studies support the association between alcohol use and sickness absence. However, previous studies have had limitations regarding measurement of sickness absence and evidence on causality. Moreover, knowledge about vulnerable subgroups particularly at-risk for sickness absence due to heavy drinking is lacking.

What this study adds?

In a case-crossover design, we demonstrate that increased drinking is associated with increased risk of both short- and long-term sickness absence. Individuals with low socioeconomic status were particularly at risk for increased short-term sickness absence and long-term absence due to external causes as a result of changes in drinking pattern. Information about vulnerable groups can be used when developing interventions to prevent alcohol-related absence from work.

INTRODUCTION

The costs of alcohol-related sickness absences are estimated to be high.[1, 2] A recent review of 28 studies supported the association between alcohol use and absence from work due to sickness.[3] The review also raised the question of the existence of vulnerable groups. Some previous studies have found that heavy drinking men have more sickness absences than heavy drinking women.[4-6] However, other studies have failed to support this,[7, 8] or reported no sex differences.[9, 10] People with a low socioeconomic status who drink heavily might also be at an increased risk of sickness absence, but only few studies are available to test this hypothesis.[8, 11]

A largely neglected but plausible moderating factor for the association between alcohol use and sickness absence is the length of the sickness absence period. Short-term sickness absence is often self-certified, and may thus reflect the immediate effects of heavy drinking (e.g., hangover). In contrast, long-term, medically certified absences are a more valid measure of health, and may reflect the long-term alcohol-related disease burden.[12-14] At least one previous study has examined this issue and found a stronger association between alcohol use and short-term absences than between alcohol use and long-term absence episodes.[14]

Previous studies have several limitations. First, sickness absence is often based on self-reports, although objective register data would be more reliable indicators and would prevent misreporting.[6-8] Second, of the 28 studies included in the recent review, only four were longitudinal.[3] Thus, the majority of the studies have been unable to establish temporality

between alcohol use and sickness absence. Third, few studies have focused on cause-specific sickness absence,[15] although previous research has shown that comorbidity of mental and substance use disorders are common,[16] and that women with a comorbid mental disorder and alcohol dependence have considerably more sickness absences than those with mental health-related problems only.[11] Strong evidence exists that higher alcohol intake is linked to an increased risk of injury.[17]

To address some of these limitations, we examined how changes in drinking are related to changes in sickness absence over time, using a case-crossover study design in which each case serves as their own control,[18] as shown in Figure 1. This method controls for all measured and unmeasured time-invariant confounders, such as sex, education level, genetic background, and personality by design.[19] In addition to sickness absence due to any cause, we focused on sickness absences due to mental disorder, and injury or poisoning.

METHODS

Design

This case-crossover study is nested in the prospective Finnish Public Sector cohort study of employees from 10 municipalities and 21 hospitals,[20] which was approved by the ethics committee of the Hospital District of Helsinki. The eligible population comprised employees who responded to at least two of three questionnaire surveys in 2000, 2004, and 2008, were alive, and not on disability pension one year after their last survey response. We used data from longitudinal cohort study in a case-crossover design, where each individual serves as their "case" (sickness absence within one year of the survey) and "control" (no sickness absence within one year of the survey). We compared the data from the "case" time point to the data from the "control" time point (Figure 1). This design can be used in longitudinal analyses when individuals' outcome statuses change (here change in sickness absence) between the measurement points. This is illustrated in Figure 1 as missing values for IDs #2, #4, #6, #8, #9, #11, #12. Case-crossover design compares exposed time to unexposed time (exposure is heavy drinking) before the outcome at case period with exposed time to unexposed time during control periods.

Exposure: Heavy drinking

In all surveys, alcohol use was assessed by participants' weekly consumption of alcohol and extreme drinking sessions. One drink was approximately equivalent to one unit or one glass

of alcoholic drink or 12 g of alcohol. Alcohol intake was dichotomized into no use or moderate use (a maximum of 140 g, equaling 11.6 units for women; and 280 g, equaling 23.3 units for men) versus greater alcohol use, indicating intake above the recommended limit.[21] The question to elicit an extreme drinking session was: “Have you ‘passed out’ due to drinking during the past year?” The responses were dichotomized into “never” and “once or more”. These two measures were combined into “heavy drinking”, defined as either a weekly intake that exceeded recommendations or having an extreme drinking session.[22]

Outcome: Sickness absence

Survey data from 2000, 2004 and 2008 were linked to sickness absence records from employer registers (self-certified short-term absence episodes) and from the Social Insurance Institution (all medically certified episodes of >9 days and related diagnoses) through the personal identity number that is unique to each Finnish resident.

We measured absence episodes of one to three days as short-term absence episodes. The number of short-term sickness absence episodes were dichotomized as 0–2 or >2 episodes per year. Data on short-term episodes were available for municipal employees only (hospital staff were excluded). Short-term sickness absence data were linked only to the respondents who had given written consent for data linkage (10% declined) and who remained employed one year after the survey. As regards short-term sickness absence, the eligible population was 22 963 employees.

The Social Insurance Institution register records the beginning and ending dates for all reimbursed episodes of sickness absences that lasted over nine days. The eligible all-cause sickness absence population was 42 627 employees. From 2004 onwards, all such episodes have been recorded using ICD-10 -based diagnoses.[23] We used codes F00–F99 to define mental disorder-related sickness absence, and codes S00–T98 to define injury or poisoning-related sickness absence. The eligible cause-specific sickness absence population was 27 189 employees. The number of sickness absence episodes of all-cause, mental disorder and external causes (injury/poisoning) were dichotomized as 0 or ≥1 episode per year.

Covariates

Covariates were baseline characteristics and potential time-dependent confounding factors measured in 2000, 2004 or 2008. Sex, age (continuous variable) and occupational position based on occupational title (coded as non-manual and manual) were retrieved from the employers' registers. Data on education were obtained from Statistics Finland, and dichotomized into up to 12 years (basic or intermediate education) and over 12 years (high education). In each survey, body mass index (BMI=weight in kilograms divided by height in meters squared) was dichotomized as less than 30 (non-obese) and 30 or more (obese).[24] Smoking was dichotomized into current smoker and non-smoker (including never smokers and ex-smokers).[25] Participants were categorized as being physically inactive if they reported less than two metabolic equivalent task hours per day (approximately 30 min. of walking) and active if more than this.[26]

Statistical analyses

We used conditional logistic regression (the LOGISTIC procedure in SAS) to assess the odds ratio of sickness absence for exposed time (i.e., the time of reported heavy drinking) compared to unexposed time (i.e., the time of reported low-risk drinking). The statistical model was, by design, adjusted for all time-invariant variables in addition to the time of the survey (2000/2004/2008) (Model 1). Additional adjustments were made for individual-level time-varying covariates: smoking, BMI, and physical inactivity measured in 2000, 2004 and 2008 (Model 2).

In addition, we analyzed direction of change in alcohol use by testing two separate models, one including participants who were not heavy drinkers in the first survey but reported heavy drinking in the second survey ("new heavy drinker", for example ID #3 and #7 in Figure 1) and the other including participants who were first heavy drinkers but later reduced drinking to lower levels ("former heavy drinker", for example ID #1 in Figure 1). Those with unchanged drinking pattern across the two surveys were excluded from these analyses (e.g., ID #5 in Figure 1).

We then examined the odds ratio of sickness absence for exposed time (i.e., the time of reported heavy drinking) compared to unexposed time (i.e., the time of reported low-risk drinking) in analyses stratified by sex, education and occupational position. These subgroups were selected because previous studies have found major differences between the alcohol intake of men and women.[7, 27] While socioeconomic disparities are smaller with regards to alcohol intake,[28, 29] alcohol-related harms have a clear socioeconomic gradient.[30, 31]

Finally, we examined whether mental (12-item General Health Questionnaire[32]) or somatic health (from medical registers) acted as a mediator in the association between change in drinking and change in sickness absence. These results are presented in online supplements. All the analyses were performed using SAS 9.4 statistical software (SAS Institute Inc., Cary, NC, USA).

RESULTS

The participants' mean age was 43–44 years, 77–90% were women, and 10–23% were men, depending on the case-crossover sample. The proportion of manual or service workers was 39–48%, 47–54% had less than 12 years of education (basic to intermediate level), and 45–53% had an education of over 12 years. As regards health behaviors, 22–23% reported smoking, 12–14% were obese, and 17–21% were physically inactive. The prevalence of heavy drinking varied between 15–18%, depending on the sample. Of the participants, 17–20% changed their drinking status during the time between the two surveys. (Table 1.) The characteristics of excluded population (no changes in outcome variables) are shown in Supplementary Table 1.

Table 1. Characteristics of study participants at first "case" measurement in each case-crossover sample.

		Short-term SA (n=5664-5809)	All-cause SA (n=12752-13103)	Mental SA (n=1464-1502)	SA due to injury/poisoning (n=1172-1205)
Number of measurements:	Two	51%	50%	100%	100%
	Three	49%	50%	0%	0%
Sex:	Men	14%	15%	10%	23%
	Women	86%	85%	90%	77%
Occupational position:	Manual/service	43%	44%	39%	48%
	Non-manual	57%	56%	61%	52%
Education:	≤12 years	54%	52%	47%	54%
	>12 years	46%	48%	53%	45%
Smoking:	Yes	23%	20%	22%	22%
	No	77%	80%	78%	78%
BMI:	<30	87%	86%	86%	88%
	≥30	13%	14%	14%	12%
Physically active:	Yes	81%	79%	79%	83%
	No	19%	21%	21%	17%
Heavy drinking:	Yes	17%	15%	18%	18%
	No	83%	85%	82%	82%

Change in drinking:	Yes	19%	17%	20%	20%
	No	81%	83%	80%	80%
Age, mean (SD)		42.9 (7.9)	44.3 (8.2)	43.4 (7.5)	43.5 (7.7)

Note. The number of study participants varies by outcome as only those with no missing data and whose outcome status changed during the follow-up were included. The number of participants is therefore presented as a range.

Table 2 shows results from case-crossover analysis for risk of sickness absence by exposure to alcohol use. Times exposed to heavy drinking compared to other times were associated with an increased risk of short-term absences in a multivariable adjusted model (OR=1.21, 95% CI 1.07-1.38). For longer sickness absence episodes, the association between heavy drinking and sickness absence was non-significant.

In analysis including only the employees who had been low-risk drinkers and had become heavy drinkers, i.e., who had increased their drinking, the odds ratio of short-term absence was 1.27 times higher (95% CI 1.07-1.52) during the time of heavy drinking. The corresponding odds ratio for long-term absence was 1.38 times higher (95% CI 1.21-1.57). However, diagnosis-specific analyses showed that this increase in drinking was associated with lower odds of mental health-related sickness absence (OR=0.57, 95% 0.35-0.93). In analysis of participants who were heavy drinkers in the first survey, but not in the second survey, stopping heavy drinking was associated with reduced odds of short-term absence (OR=0.83, 95% CI 0.68-1.00), but higher odds of long-term absence (OR=1.27, 95% CI 1.19-1.43) (Table 2). The results were similar after additional adjustment for mental and somatic health (Supplementary Table S2).

Table 2. Case-crossover analysis of odds ratios with 95% CI for having sickness absences while being a heavy drinker. Conditional logistic regression.

Outcome		Model 1	Model 2	Model 3: New heavy drinker (from low-risk to heavy)	Model 4: Former heavy drinker (from heavy to low-risk)
Short-term SA*	N	n=5809	n=5382	n=581	n=504
	OR (95% CI)	1.20 (1.06-1.36)	1.21 (1.07-1.38)	1.27 (1.07-1.52)	0.83 (0.69-1.00)
All-cause SA†	N	n=13103	n=12120	n=1006	n=1129
	OR (95% CI)	1.03 (0.94-1.12)	1.03 (0.94-1.13)	1.38 (1.21-1.57)	1.27 (1.19-1.43)
Mental SA‡	N	n=1502	n=1369	n=114	n=160
	OR (95% CI)	0.88 (0.67-1.15)	0.91 (0.68-1.21)	0.57 (0.35-0.93)	0.83 (0.55-1.23)
SA due to injury/poisoning§	N	n=1205	n=1091	n=93	n=120
	OR (95% CI)	1.17 (0.95-1.72)	1.27 (0.93-1.74)	1.33 (0.81-2.20)	0.77 (0.50-1.18)

Model 1: Adjusted for measurement phase only.

Model 2: Adjusted for measurement phase, smoking, BMI, and physical inactivity.

Model 3: Analysis included only employees with increased drinking ("new heavy drinker"). Adjusted for measurement phase, smoking, BMI, and physical inactivity.

Model 4: Analysis included only employees with decreased drinking ("former heavy drinker"). Adjusted for measurement phase, smoking, BMI, and physical inactivity.

* Short-term SA: sickness absence episodes lasting 1-3 days. We compared participants with 0-2 such episodes to those with >2 episodes

† >9 All-cause SA: >9-day sickness absence episodes due to any cause (yes vs. no)

‡ Mental SA: >9-day sickness absence episodes due to mental disorders (yes vs. no)

§ SA due to injury or poisoning: >9 days sickness absence episodes due to injury or poisoning (yes vs. no)

Effect modification by sex was statistically significant regarding the association between heavy drinking and short-term sickness absence (p=0.04). The adjusted odds of short-term sickness absence were higher among heavy drinking men than among low-risk drinking men (OR=1.62; 95% CI 1.19-2.21). The corresponding odds among women were 1.15 (95% CI 1.00-1.33). (Table 3.)

Table 3. Odds ratios with 95% CI for having sickness absences while being a heavy drinker compared to while being a low-risk drinker. Conditional logistic regression stratified by sex.

Outcome		Men		Women	
Short-term SA*	N	Model 1 (n=831)	Model 2 (n=777)	Model 1 (n=4978)	Model 2 (n=4605)
	OR (95% CI)	1.66 (1.23-2.23)	1.62 (1.19-2.21)	1.13 (0.99-1.30)	1.15 (1.00-1.33)
All-cause SA†	N	Model 1 (n=2008)	Model 2 (n=1891)	Model 1 (n=11095)	Model 2 (n=10229)
	OR (95% CI)	1.18 (0.98-1.43)	1.17 (0.96-1.43)	1.00 (0.90-1.10)	1.00 (0.90-1.11)
Mental SA‡	N	Model 1 (n=147)	Model 2 (n=140)	Model 1 (n=1355)	Model 2 (n=1229)
	OR (95% CI)	1.64 (0.74-3.59)	1.86 (0.80-4.33)	0.81 (0.61-1.09)	0.83 (0.61-1.13)
SA due to injury/poisoning§	N	Model 1 (n=274)	Model 2 (n=252)	Model 1 (n=931)	Model 2 (n=839)
	OR (95% CI)	1.27 (0.70-2.33)	1.30 (0.69-2.44)	1.28 (0.91-1.78)	1.27 (0.88-1.83)

Model 1: Crude, adjusted for measurement phase only.

Model 2: Adjusted additionally for smoking, BMI, and physical inactivity.

* Short-term SA: sickness absence episodes lasting 1-3 days. We compared participants with 0-2 such episodes to those with >2 episodes

† >9 All-cause SA: >9-day sickness absence episodes due to any cause (yes vs. no)

‡ Mental SA: >9-day sickness absence episodes due to mental disorders (yes vs. no)

§ SA due to injury or poisoning: >9 days sickness absence episodes due to injury or poisoning (yes vs. no)

Among participants with low to intermediate education, change in drinking was associated with a higher probability of sickness absence due to injury or poisoning (OR=1.59, 95% CI 1.04-2.44), which was not observed among those with a high education (OR=0.93, 95% CI 0.58-1.52) (Table 4.). The results were similar when stratified by occupational position. Participants in manual or service jobs who were heavy drinkers had a higher probability of sickness absence due to injury or poisoning (OR=1.84, 95% CI 1.16-2.92) than those in non-manual occupations (OR=0.90, 95% CI 0.57-1.42) (Supplementary Table S3).

Table 4. Odds ratios with 95% CIs for having sickness absences while being a heavy drinker compared to while being a low-risk drinker. Conditional logistic regression stratified by education.

		Low/intermediate (≤12 years)		High education (>12 years)	
Short-term SA*	N	Model 1 (n=3104)	Model 2 (n=2876)	Model 1 (n=2664)	Model 2 (n=2483)
	OR (95% CI)	1.23 (1.04-1.46)	1.26 (1.02-1.50)	1.17 (0.98-1.39)	1.17 (0.97-1.41)
All-cause SA†	N	Model 1 (n=6722)	Model 2 (n=6126)	Model 1 (n=6303)	Model 2 (n=5918)
	OR (95% CI)	1.02 (0.91-1.15)	1.02 (0.90-1.16)	1.03 (0.91-1.17)	1.04 (0.91-1.18)
Mental SA‡	N	Model 1 (n=700)	Model 2 (n=626)	Model 1 (n=795)	Model 2 (n=730)
	OR (95% CI)	0.78 (0.54-1.13)	0.84 (0.57-1.25)	0.96 (0.64-1.43)	0.95 (0.62-1.44)
SA due to injury/poisoning§	N	Model 1 (n=643)	Model 2 (n=585)	Model 1 (n=555)	Model 2 (n=499)
	OR (95% CI)	1.59 (1.06-2.38)	1.59 (1.04-2.44)	0.99 (0.64-1.55)	0.93 (0.58-1.52)

Model 1: Crude, adjusted for measurement phase only.

Model 2: Adjusted additionally for smoking, BMI, and physical inactivity.

* Short-term SA: sickness absence episodes lasting 1-3 days. We compared participants with 0-2 such episodes to those with >2 episodes

† >9 All-cause SA: >9-day sickness absence episodes due to any cause (yes vs. no)

‡ Mental SA: >9-day sickness absence episodes due to mental disorders (yes vs. no)

§ SA due to injury or poisoning: >9 days sickness absence episodes due to injury or poisoning (yes vs. no)

DISCUSSION

These within-individual analyses showed that episodes of heavy alcohol use, specifically increased heavy drinking is associated with short-term sickness absence. This pattern was pronounced among men and employees with a low socioeconomic status. The most common reasons for short-term absences are respiratory (such as a common cold), gastroenteritis (stomach flu), and headache/migraine.[33] Hangover can easily be linked to headache and symptoms of stomach flu. Reduced drinking, in turn, was associated with lower odds of short-term absence.

We found that change in drinking status among men and individuals with a lower socioeconomic status may be more strongly linked with change in short-term sickness absence and sickness absence due to external causes than among women or participants with a higher socioeconomic status. Our results are congruent to an earlier study, which concluded that the strongest association between alcohol use and sickness absence was found among low-educated males.[8] The drinking cultures of socioeconomic groups may differ. While absolute intake of alcohol per week may be similar and above risk levels across socioeconomic strata, employees in lower socioeconomic positions may more often consume all weekly doses at once, which may produce more adverse health consequences than consuming weekly doses on several occasions during one week, at least in the short run. In another study, extended weekends, i.e., short-term absences on Mondays and Fridays, were associated with male sex and lower income, [34] which can indicate differences in the culture of absenteeism.

Increased drinking was associated with lower odds of mental health-related sickness absences. A previous study found a strong association between alcohol abuse and increased sickness absence among women, which was highlighted in the presence of comorbid mental disorder.[11] Another study found that alcohol use disorder was associated with an increased risk of mental health-related sickness absence, but not with sickness absence due to somatic causes.[35] The reversed association found in this study was based on a rather small number of observations (n=114) and could be a chance finding, due to exclusion of stable heavy drinkers, or may be due to the use of psychotropic medication preventing alcohol use. More studies are needed to determine the relationship between alcohol use, mental health and sickness absence.

We found that a change in drinking status was associated with a higher probability of longer-term (>9 days) sickness absences due to external causes, but only among participants with a low socioeconomic status. This indicates a possible socioeconomic gradient in heavy drinking, which is illustrated by a higher rate of injury or poisoning among people with a low socioeconomic status. An alternative explanation is that the likelihood of injuries is lower in office work, which often requires higher education than physically demanding work; similarly it is probably easier to continue working while injured in an office setting.

We found no association between change in alcohol use and change in sickness absences lasting over nine days, although these longer-term medically certified absences have shown to be a global measure of health and to increase the risk of all-cause and cause-specific mortality.[12, 13] However, when controlling for the direction of the change, we found that among baseline low-risk drinkers, the odds of sickness absence lasting over nine days

increased by one third among those who began to drink above risk levels. Moreover, these odds were also higher among those who had stopped heavy drinking. Thus, quitting drinking is likely to be driven by health impairment, while beginning heavy drinking is likely to lead to health impairment. This is also a potential explanation for the considerably reduced risk of sickness absence due to mental causes among "new" heavy drinkers: A common treatment for mental disorders are antidepressants, an unmeasured time-dependent confounder, with which the use of alcohol should be avoided. The fact that short-term sickness absence, which has a weak association with major chronic diseases,[12, 13] increased and decreased in line with drinking habits lends further support to this reasoning. This also corresponds to earlier results,[14] strengthens our conclusions regarding causal associations, and adds novelty to our findings.[3]

Our study has several other strengths. The case-crossover design allowed us to eliminate all time-invariant confounding, such as that due to sex, socioeconomic and genetic background, and personality characteristics, which might have acted as confounders in the association between alcohol use and sickness absence. We were also able to include many time-varying confounders, including smoking, obesity, and physical inactivity. We did not adjust for psychosocial and physical working conditions. However, previous studies have found that adjusting for these have either no effect on or make a weak contribution to the association between alcohol use and sickness absence.[9, 36] Moreover, occupational position can be considered a proxy for physical working conditions.

The study also has limitations. Alcohol use was obtained from self-reports, which are often underestimated.[20, 36] The associations found may thus be underestimated if the time when

a participant is actually a heavy drinker is included in the low-risk drinker time point. However, as we used a within-individual approach, systematic bias is unlikely.

The decision to include abstainers among low-risk drinkers may have deflated our estimates. Abstainers (both never drinkers and former drinkers) have been found to have more sickness absences than moderate drinkers,[20, 36, 37] although some studies report no association between abstinence and sickness absence.[14, 38] A recent twin study concluded that the increased risk of sickness absence related to a low use of alcohol is not due to the causal effect of alcohol, but rather to confounding by genetic factors.[39] This result supports our choice to include abstainers in the low-risk group. Important assumptions are: equal opportunity to be exposed and unexposed during the case and control periods; exposure is transient; and outcome is clearly defined.[40] In the analyses, measurement phase was controlled for. As our study focused on a working population, transient exposure to heavy alcohol use is more probable than chronic substance use disorder (ICD-10: F10). Sickness absence was clearly defined from register data, and the results were robust to different cut-points for annual short-term sickness absence episodes. Moreover, residual time-dependent confounding is possible. For example, we did not have information on other substance use. However, we found little evidence to suggest that the associations would be attributable to chronic illness or psychiatric distress. Finally, the present study was based on a mostly female Finnish public sector employee cohort, which limits the generalizability of the results.

In conclusion, these within-individual analyses showed that increased alcohol use was associated with increased risk of both short- and long-term sickness absence. Among participants with a low socioeconomic status, change in drinking was additionally associated

with long-term sickness absence due to injury or poisoning. Further research should now determine whether workplace interventions that address the prevention of harmful alcohol use are able to decrease sickness absence rates, and whether people from low socioeconomic status groups benefit more from these interventions than those from high socioeconomic status groups.

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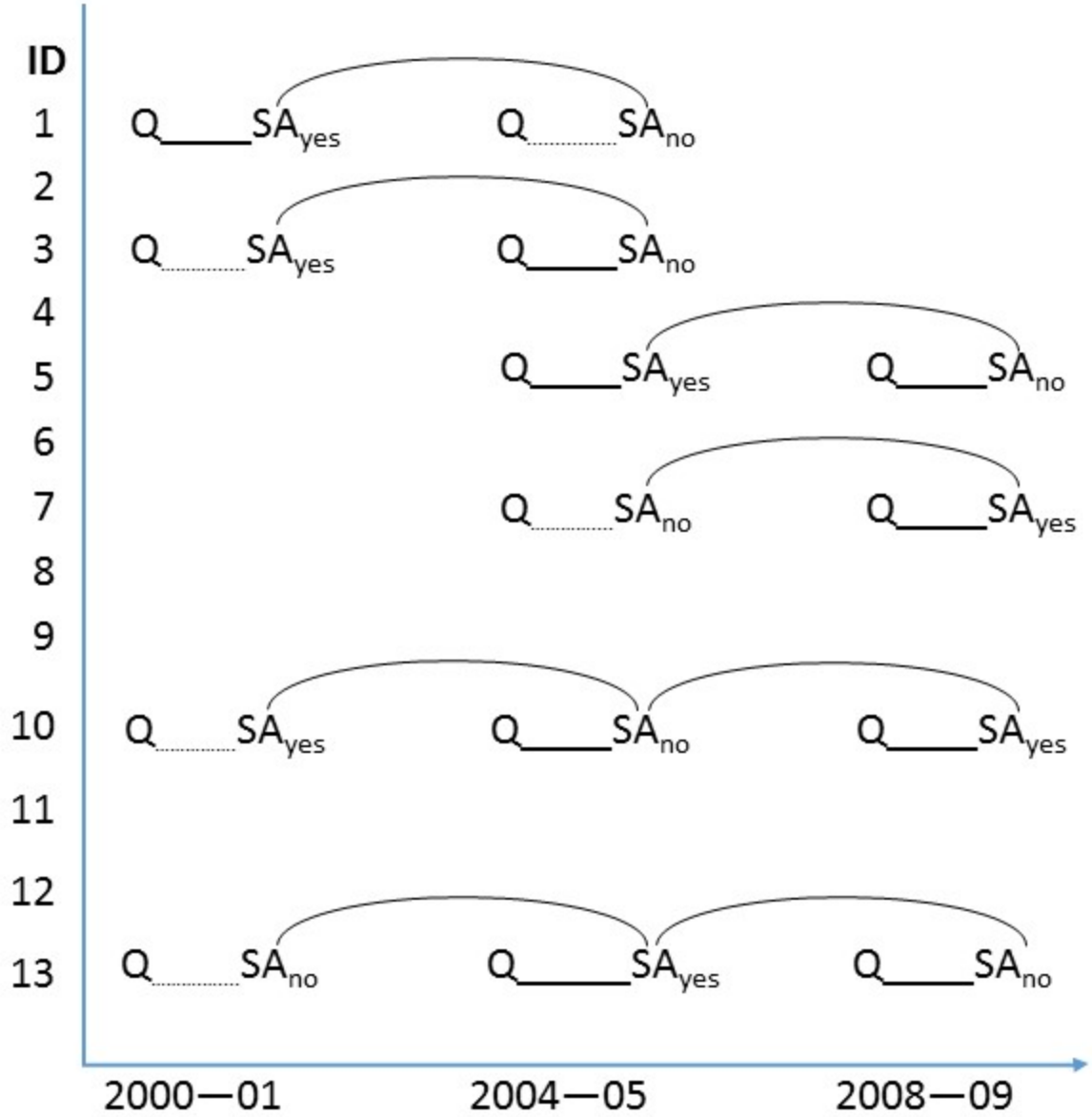
Figure legends

Figure 1. Fictitious example of participants in case-crossover study on changes in alcohol use as a predictor of changes in sickness absence.



Q = survey measurement in 2000, 2004, or 2008

__ = heavy drinking identified from survey (exposed time)
.... = low-risk drinking identified from survey (unexposed time)

SA_{yes} = sickness absence within one year of the survey (case)
SA_{no} = no sickness absence within one year of the survey (control)