

Drinking social norms and drinking behaviours: a multilevel analysis of 137 workgroups in 16 worksites

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Background: Previous studies on worksite drinking norms showed individually perceived norms were associated with drinking behaviours.

Objective: To examine whether restrictive drinking social norms shared by workgroup membership are associated with decreased heavy drinking, frequent drinking and drinking at work at the worker level.

Methods: The sample included 5338 workers with complete data nested in 137 supervisory workgroups from 16 American worksites. Multilevel models were fitted to examine the association between workgroup drinking norms and heavy drinking, frequent drinking and drinking at work.

Results: Multivariate adjusted models showed participants working in workgroups in the most discouraging drinking norms quartile were 45% less likely to be heavy drinkers, 54% less likely to be frequent drinkers and 69% less likely to drink at work than their counterparts in the most encouraging quartile.

Conclusions: Strong associations between workgroup level restrictive drinking social norms and drinking outcomes suggest public health efforts at reducing drinking and alcohol-related injuries, illnesses and diseases should target social interventions at worksites.

Alcohol-related diseases represent 4% of the global health burden.¹ In the United States the economic costs of alcohol abuse were over 184.6 billion dollars in 1998, a 25% increase from 1992.² Concerns over the role of workplaces as alcohol stimulating environments led to the 1988 Drug-free Workplace Act reinforcing the importance of employee assistance programmes in managing substance abuse. Although these programmes may be effective for secondary prevention, they are limited for primary prevention.^{3–4} Additionally, workplace factors such as psychosocial conditions and normative contexts have been proposed as primary prevention targets.^{3–5}

Ames and Janes suggested that the workplace normative context is crucial for changing drinking behaviours and preventing abusive drinking.⁴ Drinking social norms shared by a group define standards of appropriate behaviour, creating social controls that regulate workplace alcohol availability and drinking behaviours. Cross-sectional studies have reported associations between drinking social norms and drinking.^{6–8} These studies, however, included a limited number of worksites (ranging from 1–3) and analysed individually perceived norms rather than the normative worksite context. To evaluate the influence of normative contexts over an individual's behaviour requires locating people within their reference groups so that simultaneous assessment of group and individual-level influences can be made. Multilevel analysis is one approach for examining group norm influences on human behaviour and has been widely used in organisational research. Multilevel analysis disentangles sources of variability from different levels of a hierarchically nested structure, such as workers within workgroups.⁹

The multilevel approach has been echoed by the Institute of Medicine¹⁰ and highlighted in the recent STEPS conference aimed at the integration of worksite health promotion programmes with worksite health protection programmes.¹¹ Both recognise that to change behaviour and improve health requires not only a focus on the individual but also on the social environment. Surprisingly, social norms are not discussed and instead norms continue to be approached from the individual

(perceived) level in the application of health promotion theories like the sociocognitive theory and the theory of reasoned action.¹² As Sorensen *et al* have stated, research that conceptualises and analyses social norms at a social level hopefully moves public health towards socially based interventions.¹³

The Work and Alcohol Study was conducted to evaluate the impact of normative worksite contexts on drinking behaviours. Groups of workers reporting to the same supervisor were surveyed on drinking and drinking norms while preserving their nesting within the organisation. Three different drinking behaviours were defined to evaluate the associations with drinking social norms: heavy drinking, frequent drinking and drinking at work. We proposed the hypothesis that restrictive drinking social norms shared by workgroups will be associated with decreases in heavy drinking, frequent drinking and drinking at work at the individual level, after controlling for a range of known covariates.

METHODS

Sample

The present work is part of the Worksite Alcohol Study phase II (WAS-II) conducted in 1994. Sampling procedures have been described elsewhere.^{14–15} Briefly, a random sample of 16 worksites from six Fortune 500 companies was selected from 114 worksites participant in the WAS-I. Worksites were selected without replacement to represent equally six strata created by cross-classifying information obtained from structured interviews with managers on worksite dominant occupations (ie, professionals, service and manufacturing) and worksite management drinking tolerance (ie, liberal/conservative). Measures of worksite management tolerance were based on responses of managers to questions about how tolerant the worksite was about drinking in an earlier survey of the same worksites.¹⁶ Supervisory workgroups were established in conjunction with management, identifying groups of workers reporting to the same supervisor in the organisational charts,

Abbreviations: ICC, intraclass correlation coefficient; OR, odds ratio

under the premise that they should represent well-contained production processes. At smaller worksites ($n \leq 800$), all supervisory workgroups and workers were asked to participate. At larger worksites, supervisory workgroups were randomly selected, and workers within workgroups were asked to participate, to cover a quota of 500 workers from each worksite. Workers' link to supervisory workgroups was preserved. Surveys were mailed to worker homes; 6537 workers linked to 155 supervisory workgroups responded to the survey (71% response rate).

The final analytic sample included 5338 workers and 137 supervisory workgroups after excluding workers with missing data. Comparison of the full sample with the analytic sample showed no differences (table available from corresponding author).

Drinking behaviours

Three distinct drinking behaviours were defined for the analysis. Frequent drinking and heavy drinking were chosen to depict how often and how much a person drinks, following similar categorisations used in other alcohol studies.^{17, 18} Additionally, a third variable indicating whether drinking behaviour occurred in work-related situations was also measured. Frequency and amount of drinking were measured as ordinal measures, and following other work and drinking researched, collapsed for the analyses into dichotomous indicators of frequent and heavy drinking behaviours. Workers were classified as frequent drinkers if during the past 30 days they had drunk any beer, wine or liquor on 5 or more days in a week. Heavy drinking was defined according to Wechsler and colleagues.¹⁹ Men were considered heavy drinkers if they had drunk five or more drinks in one day in the past month, whereas for women the cut-off point was four or more drinks. Drinking at work was an endorsement of different ways of drinking while at work that was collapsed into a dichotomous indicator. Workers were considered to drink at work if they reported drinking during the workday or if they had drunk alcohol in the past 30 days 2 hours before going to work, during lunch or work break, while working, before driving a vehicle on company business or at a company-sponsored event. All three drinking measures have been found to be valid and reliable.^{20, 21}

Preliminary analyses indicated that each measure of drinking behaviour provided unique information; cross-classification of the three drinking behaviour showed that only 70 (1.3%) workers had all three behaviours and, overall, between 20% and 30% of the workers had more than one drinking behaviour. Among frequent drinkers, however, 52% were also heavy drinkers, and 41% of those who drank at work were also heavy drinkers. Thus, despite some inter-relationship, the three drinking measures captured different types of behaviours.

Drinking social norms

The drinking norms scale was originally developed by the research group based on the work of Ajzen and Fishbein²² and the review of the social norms literature. The scale collects information on two components of norms about drinking, one general and another work-specific. Psychometric analyses indicated these two components constituted a single dimension, named "drinking social norms". Drinking norms were measured with eight statements: (a) having a drink or two at home after work is a harmless way to relax and unwind; (b) getting together for drinks once in a while after work with coworkers can improve employees' morale; (c) drinking with clients or customers is good for business; (d) supervisors miss key information if they don't socialise with colleagues over a drink; (e) a drink or two a day is good for a person's health; (f)

a few beers or drinks at lunch are a reasonable way to deal with a boring or repetitive job; (g) the more frequently people are exposed to alcohol, the more likely they are to develop a drinking problem; and (h) serving alcohol at company social events sets a bad example for employees. Workers reported their agreement from one to four points (strongly agree, agree, disagree, strongly disagree). All items were rescored so high scores meant drinking was more undesirable or inappropriate. For each participant, the mean score of all eight items was computed ($\alpha = 0.79$). Individual scores varied from 1.25 to 4 (mean 2.9).

To evaluate the extent that the variability of individual-level norms could be attributed to effects at the workgroup level, we estimated the intraclass correlation coefficient (ICC). Briefly, the ICC is the proportion of the total variance accounted for by the second level variance.⁹ A two-level random intercept model with the individual-level drinking norms variable set as the outcome was fitted and variance components for level one and two were estimated. Level one variance was 0.229 while level two was 0.024, providing an ICC of 0.095. Thus, 9.5% of the variability observed in the individual norms scale can be attributed to the group level, supporting the decision to analyse the data in a multilevel fashion.

To represent workgroup drinking social norms, an aggregate measure was created by averaging individual scores within supervisory workgroups. Workgroup social norms ranged from 2.58 to 3.36 (mean 2.92), larger values implying more discouraging norms towards drinking. The validity of an aggregate measure is based on the assumption that there is high within-group agreement among the workers in a supervisory group. Homogeneity of agreement within groups was assessed using the $r_{wg(J)}$ index.²³ This index is calculated by comparing an observed group variance with an expected random variance. It is independent of the between-groups variance, so it is particularly useful when group means are restricted in their range. Rather than obtaining a single summary for the entire sample as with the ICC, the $r_{wg(J)}$ index provides an agreement measure for each group. All but one ($r_{wg(J)} = 0.64$) workgroup had $r_{wg(J)}$ values above 0.70 (median 0.90), indicating strong homogeneity and supporting the validity of aggregating individual-level data to the workgroup level.

A compositional effects test was conducted to evaluate the predictive power of the aggregate measure beyond what could be explained by its origin individual variable. Compositional effects are the residual association between the aggregate measure and the outcome once the individual-level variable used to generate the aggregated measure has been taken into account.^{9, 24} Compositional effects differ from contextual effects in that the former are observed upon aggregation of individual data to the group level (eg, the group average of individuals' drinking norms), while the latter represent information directly measured at the group level (eg, written workgroup drinking policies).²⁵ The compositional effects test decomposes observed effects into individual (ie, perceived drinking norms) and workgroup level (ie, drinking social norms) effects. Logistic regression models for each outcome were fitted with the individual and the aggregated drinking social norms measures. Statistically significant compositional effects (workgroup effects) were observed for heavy drinking ($p = 0.012$), frequent drinking ($p = 0.03$) and drinking at work ($p < 0.001$). For each outcome, the statistically significant differences between the individual and aggregated coefficients supported the statement that the aggregate measure had predictive power beyond the level that could be explained from the individual variable.

To examine the dose-response in the relationship between drinking social norms and drinking behaviours, the aggregated

Table 1 Distribution of sample characteristics (n = 5338)

Characteristics	No (%)
<i>Sociodemographics</i>	
Gender (female)	2059 (38.6)
Age (years)	
≤ 34	1451 (27.2)
35–44	1769 (33.1)
45–54	1534 (28.7)
≥ 55	584 (10.9)
Race	
White, non-Hispanic	4618 (86.5)
Hispanic	184 (3.4)
African-American	371 (7.0)
Other	165 (3.1)
Education	
≤ High school	1588 (29.7)
Technical school	599 (11.2)
Some college	983 (18.4)
Two year college degree	466 (8.7)
Four year college degree	1081 (20.3)
Graduate degree	621 (11.6)
Religiosity	
Once or more a week	1639 (30.7)
At least once a month	1477 (27.7)
Less than twice a year	2222 (41.6)
Marital status	
Never married	733 (13.7)
Married	3016 (56.5)
Separated	741 (13.9)
Remarried	848 (15.9)
Living with children (yes)	2429 (45.5)
<i>Health-related</i>	
Smoker	
Never	2502 (46.9)
Ex-smoker	1647 (30.9)
Smoker	1189 (22.3)
<i>Occupational</i>	
Working offsite (yes)	1275 (23.9)
Annual salary (\$)	
<20K	400 (7.5)
20–29K	1335 (25.0)
30–39K	1203 (22.5)
40–49K	876 (16.4)
50–59K	718 (13.5)
>60K	806 (15.1)
Availability of alcohol at work (low)	2157 (40.4)
<i>Drinking</i>	
Heavy drinking (yes)	1015 (19.0)
Frequent drinking (yes)	423 (7.9)
Drinking at work (yes)	577 (10.8)
<i>Design effects</i>	
Worksite dominant occupation	
Professional	1379 (25.8)
Service	1201 (22.5)
Manufacturing	2758 (51.7)
Management drinking tolerance (liberal)	2377 (44.5)

workgroup drinking social norms measure was divided into four groups based on the quartile distribution (cut-off points were 2.77, 2.93 and 3.03). Thus, workgroups in the first quartile had the most encouraging drinking norms while those in the fourth quartile had the most discouraging.

Covariates

Covariates selected based on the literature^{26–31} included gender, age, race/ethnicity, education, frequency of attendance at religious services (ie, religiosity), marital status, living with children, family history of alcohol abuse, self-rated health, smoking status, job category, job seniority, weekly working hours, ambient hazards level, working offsite, working shift, unionisation, salary, job insecurity, alcohol availability at work, psychological job demands, job control and number of workers (in increments of 10 workers) in each supervisory workgroup. Finally, alcohol availability at work captured the ease of

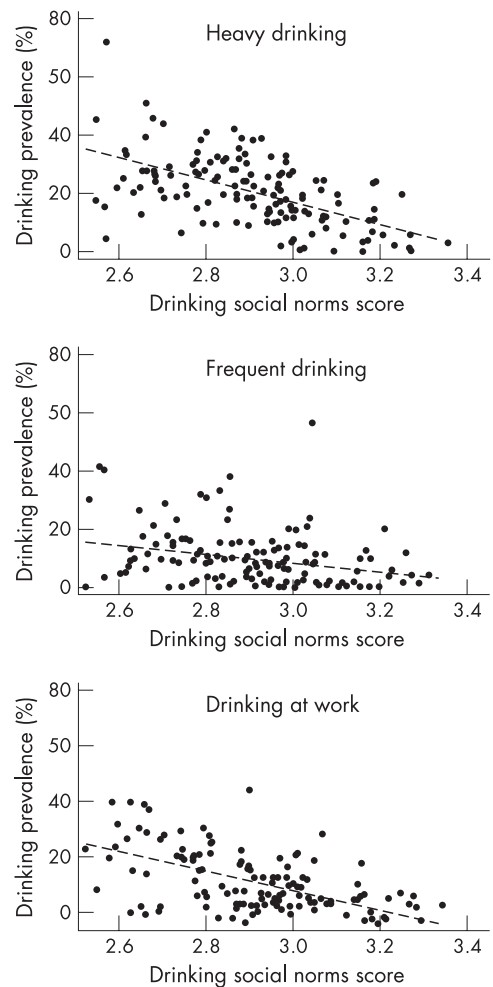


Figure 1 Scatter plot of the prevalence of drinking behaviours and drinking social norms among 137 workgroups.

bringing alcohol to work, having a drink of alcohol during a break and having a drink of alcohol while working.

A covariate was included in the final model if it: (a) was not highly correlated with another covariate ($r \leq 0.70$); (b) was associated with a drinking outcome in unadjusted regression analysis ($p < 0.25$); and (c) continued to be significantly associated with the drinking outcome ($p \leq 0.05$) in a final multilevel logistic regression model which included all selected covariates. Non-significant variables in the final multiple regression models were individually re-entered to reassess statistical significance. Table 1 shows the covariates included in final models, and their categorisation.

Statistical analysis

To examine the association between norms and drinking, two-level random intercept logistic regression models were specified:

$$\text{Logit}(\pi_{ij}) = \beta_0 \text{ cons} + \beta_1 \text{ norms}_j + \beta_2 \text{ covariates}_{ij} + \beta_3 \text{ design}_j + u_j$$

Here, π_{ij} denotes the probability that the i th worker (level 1) in the j th group (level 2) will exhibit the drinking behaviour being analysed. The group level random error term is u_j . The term “cons” is equal to 1 so that β_0 represents the intercept for the model, “covariates” represents the vector of selected covariates and the “design” vector comprises the two variables (management drinking tolerance and worksite dominant occupation) used to construct the sampling strata. The “norms” term represents workgroup drinking social norms as quartiles,

Table 2 Bivariate associations between sample characteristics and heavy drinking, frequent drinking and drinking at work (n = 5338)*

Characteristics	Heavy drinking			Frequent drinking			Drinking at work		
	%	OR (95% CI)	p Value	%	OR (95% CI)	p Value	%	OR (95% CI)	p Value
<i>Workgroup drinking social norms†</i>									
1st Quartile	24.8	1		10.7	1		23.7	1	
2nd Quartile	23.9	0.84 (0.65 to 1.10)	0.205	9.3	0.82 (0.55 to 1.22)	0.327	12.4	0.57 (0.40 to 0.80)	0.001
3rd Quartile	18.7	0.58 (0.44 to 0.78)	<0.001	7.2	0.59 (0.39 to 0.92)	0.018	7.3	0.45 (0.31 to 0.65)	<0.001
4th Quartile	10.9	0.38 (0.27 to 0.54)	<0.001	5.4	0.36 (0.22 to 0.60)	<0.001	3.4	0.20 (0.12 to 0.34)	<0.001
<i>Sociodemographics</i>									
<i>Gender</i>									
Male	20.2	1		10.4	1		13.0	1	
Female	17.1	0.55 (0.47 to 0.65)	<0.001	3.9	0.37 (0.28 to 0.48)	<0.001	7.3	0.47 (0.38 to 0.59)	<0.001
<i>Age (years)</i>									
≤ 34	31.7	1		5.4	1		10.4	1	
35–44	18.8	0.52 (0.44 to 0.62)	<0.001	8.5	1.47 (1.10 to 1.96)	0.009	11.7	1.07 (0.85 to 1.36)	0.549
45–54	11.9	0.32 (0.26 to 0.39)	<0.001	9.1	1.56 (1.16 to 2.11)	0.003	11.2	1.16 (0.91 to 1.49)	0.228
≥ 55	6.7	0.17 (0.12 to 0.24)	<0.001	9.4	1.62 (1.12 to 2.36)	0.011	8.2	0.94 (0.65 to 1.34)	0.724
<i>Race</i>									
White, non-Hispanic	19.8	1		7.8	1		10.9	1	
Hispanic	20.7	1.13 (0.78 to 1.64)	0.508	7.6	0.97 (0.55 to 1.69)	0.911	10.3	1.17 (0.71 to 1.92)	0.539
African-American	12.4	0.53 (0.38 to 0.74)	<0.001	10.2	1.44 (1.01 to 2.06)	0.047	11.1	1.24 (0.87 to 1.75)	0.236
Other	10.9	0.50 (0.30 to 0.82)	0.006	6.1	0.74 (0.38 to 1.41)	0.359	7.3	0.58 (0.32 to 1.08)	0.085
<i>Education</i>									
≤ High school	13.7	1		7.8	1		4.6	1	
Technical school	18.5	1.49 (1.16 to 1.92)	0.002	7.0	0.86 (0.60 to 1.24)	0.414	6.5	1.38 (0.92 to 2.06)	0.121
Some college	21.0	1.44 (1.16 to 1.79)	0.001	7.2	1.01 (0.74 to 1.38)	0.935	9.4	1.99 (1.44 to 2.76)	<0.001
Two year college degree	16.1	1.05 (0.78 to 1.40)	0.748	4.7	0.63 (0.39 to 1.00)	0.053	10.9	2.19 (1.49 to 3.21)	<0.001
Four year college degree	25.9	1.86 (1.51 to 2.29)	<0.001	8.8	1.21 (0.90 to 1.62)	0.203	15.9	2.98 (2.21 to 4.03)	<0.001
Graduate degree	20.1	1.37 (1.06 to 1.78)	0.018	11.1	1.39 (0.99 to 1.95)	0.059	24.2	3.66 (2.65 to 5.06)	<0.001
<i>Religiosity</i>									
Once or more a week	10.6	1		4.6	1		8.1	1	
At least once a month	19.4	1.97 (1.61 to 2.42)	<0.001	6.2	1.38 (1.01 to 1.90)	0.042	11.4	1.38 (1.08 to 1.77)	0.010
Less than twice a year	24.9	2.73 (2.26 to 3.28)	<0.001	11.5	2.78 (2.13 to 3.63)	<0.001	12.4	1.64 (1.31 to 2.06)	<0.001
<i>Marital status</i>									
Never married	35.5	1		5.7	1		12.8	1	
Married	15.1	0.36 (0.30 to 0.44)	<0.001	7.7	1.22 (0.87 to 1.73)	0.250	10.6	0.82 (0.63 to 1.06)	0.139
Separated	21.9	0.55 (0.44 to 0.70)	<0.001	7.6	1.31 (0.86 to 1.99)	0.205	10.5	0.95 (0.68 to 1.32)	0.752
Remarried	16.4	0.43 (0.33 to 0.55)	<0.001	11.1	1.85 (1.25 to 2.73)	0.002	10.1	0.94 (0.68 to 1.31)	0.727
<i>Living with children</i>									
No	21.8	1		8.1	1		11.1	1	
Yes	15.7	0.68 (0.59 to 0.78)	<0.001	7.7	0.91 (0.75 to 1.12)	0.376	10.4	0.83 (0.69 to 0.99)	0.039
<i>Health-related</i>									
<i>Smoker</i>									
Never	16.1	1		5.4	1		10.1	1	
Ex-smoker	18.8	1.29 (1.10 to 1.53)	0.002	9.0	1.72 (1.35 to 2.20)	<0.001	12.3	1.40 (1.14 to 1.72)	0.001
Smoker	25.6	1.95 (1.64 to 2.31)	<0.001	11.8	2.50 (1.94 to 3.22)	<0.001	10.3	1.39 (1.09 to 1.76)	0.007
<i>Occupational</i>									
<i>Working offsite</i>									
No	18.5	1		7.0	1		7.7	1	
Yes	20.8	1.14 (0.97 to 1.35)	0.118	10.9	1.49 (1.19 to 1.87)	0.001	20.6	2.13 (1.76 to 2.59)	<0.001
<i>Annual salary (\$)</i>									
<20K	20.8	1		3.3	1		4.3	1	
20–29K	18.1	1.13 (0.84 to 1.51)	0.413	3.7	1.15 (0.61 to 2.16)	0.673	5.6	1.78 (1.02 to 3.10)	0.041
30–39K	17.5	1.31 (0.96 to 1.78)	0.090	7.6	2.35 (1.26 to 4.38)	0.007	8.2	2.44 (1.38 to 4.30)	0.002
40–49K	20.8	1.76 (1.27 to 2.44)	0.001	9.5	2.94 (1.56 to 5.56)	0.001	10.1	2.95 (1.65 to 5.28)	<0.001
50–59K	20.8	1.67 (1.19 to 2.34)	0.003	11.0	3.64 (1.91 to 6.92)	<0.001	13.2	3.81 (2.12 to 6.82)	<0.001
>60K	18.5	1.32 (0.94 to 1.85)	0.112	13.4	4.51 (2.39 to 8.51)	<0.001	25.3	6.20 (3.52 to 10.92)	<0.001
<i>Availability of alcohol at work</i>									
High	17.2	1		7.9	1		11.3	1	
Low	21.7	0.79 (0.70 to 0.91)	0.001	8.0	0.93 (0.76 to 1.14)	0.485	10.1	1.09 (0.90 to 1.31)	0.365
<i>Workgroup size</i>									
Number of people (increments of 10)		0.96 (0.95 to 0.98)	<0.001		0.96 (0.94 to 0.98)	<0.001		0.96 (0.94 to 0.98)	<0.001
<i>Design effects</i>									
<i>Worksite dominant occupation‡</i>									
Professional	21.3	1		9.6	1		22.1	1	
Service	25.8	1.30 (1.08 to 1.56)	0.005	4.7	0.46 (0.34 to 0.64)	<0.001	6.6	0.25 (0.20 to 0.33)	<0.001
Manufacturing	14.9	0.67 (0.57 to 0.80)	<0.001	8.5	0.91 (0.72 to 1.14)	0.423	7.0	0.31 (0.25 to 0.37)	<0.001
<i>Management drinking tolerance‡</i>									
Liberal	21.3	1		8.6	1		15.5	1	
Conservative	17.2	0.85 (0.74 to 0.98)	0.025	7.4	0.82 (0.67 to 1.01)	0.064	7.0	0.49 (0.40 to 0.58)	<0.001

*All bivariate analyses were conducted including design variables (worksite dominant occupation and management drinking tolerance).

†Quartile ranges: 1st 2.58–2.77, 2nd 2.78–2.93, 3rd 2.94–3.03, 4th 3.04–3.36.

‡Worksite dominant occupation adjusting for management drinking tolerance and vice versa.

Table 3 Adjusted models between drinking social norms and heavy drinking, frequent drinking and drinking at work (n = 5338)

Characteristics	Heavy drinking		Frequent drinking		Drinking at work	
	OR (95% CI)	p Value	OR (95% CI)	p Value	OR (95% CI)	p Value
<i>Workgroup Drinking Social Norms*</i>						
1st Quartile	1		1		1	
2nd Quartile	0.97 (0.76 to 1.24)	0.807	0.90 (0.62 to 1.29)	0.561	0.69 (0.49 to 0.97)	0.031
3rd Quartile	0.71 (0.54 to 0.94)	0.015	0.64 (0.43 to 0.95)	0.026	0.54 (0.37 to 0.78)	0.001
4th Quartile	0.55 (0.39 to 0.78)	<0.001	0.46 (0.29 to 0.74)	0.001	0.31 (0.19 to 0.50)	<0.001
<i>Sociodemographics</i>						
<i>Gender</i>						
Male	1		1		1	
Female	0.57 (0.47 to 0.69)	<0.001	0.48 (0.36 to 0.64)	<0.001	0.67 (0.53 to 0.86)	0.001
<i>Age (years)</i>						
≤ 34	1					
35–44	0.48 (0.39 to 0.59)	<0.001				
45–54	0.25 (0.19 to 0.31)	<0.001				
≥ 55	0.12 (0.08 to 0.18)	<0.001				
<i>Race</i>						
White, non-Hispanic	1		1		1	
Hispanic	1.00 (0.67 to 1.50)	0.988	0.95 (0.53 to 1.71)	0.868	1.29 (0.76 to 2.17)	0.349
African-American	0.53 (0.38 to 0.75)	<0.001	2.17 (1.48 to 3.19)	<0.001	1.89 (1.30 to 2.74)	0.001
Other	0.41 (0.24 to 0.68)	<0.001	0.62 (0.32 to 1.22)	0.167	0.44 (0.23 to 0.83)	0.011
<i>Education</i>						
≤ High school	1				1	
Technical school	1.44 (1.10 to 1.89)	0.008			1.24 (0.82 to 1.88)	0.315
Some college	1.24 (0.98 to 1.57)	0.067			1.80 (1.29 to 2.52)	0.001
Two year college degree	0.88 (0.64 to 1.21)	0.427			1.93 (1.29 to 2.88)	0.001
Four year college degree	1.33 (1.03 to 1.71)	0.026			2.28 (1.63 to 3.21)	<0.001
Graduate degree	1.00 (0.72 to 1.37)	0.980			2.42 (1.65 to 3.56)	<0.001
<i>Religiosity</i>						
Once or more a week	1		1		1	
At least once a month	1.67 (1.35 to 2.08)	<0.001	1.29 (0.94 to 1.78)	0.118	1.40 (1.08 to 1.81)	0.011
Less than twice a year	2.11 (1.73 to 2.58)	<0.001	2.47 (1.88 to 3.26)	<0.001	1.74 (1.37 to 2.21)	<0.001
<i>Marital status</i>						
Never married	1					
Married	0.53 (0.42 to 0.67)	<0.001				
Separated	1.02 (0.77 to 1.34)	0.892				
Remarried	0.66 (0.49 to 0.89)	0.006				
<i>Living with children</i>						
No	1				1	
Yes	0.76 (0.64 to 0.90)	0.002			0.78 (0.64 to 0.94)	0.011
<i>Health-related</i>						
<i>Smoker</i>						
Never	1		1		1	
Ex-smoker	1.77 (1.47 to 2.13)	<0.001	1.60 (1.24 to 2.06)	<0.001	1.55 (1.25 to 1.92)	<0.001
Smoker	2.36 (1.93 to 2.87)	<0.001	2.47 (1.26 to 4.88)	0.009	1.78 (1.37 to 2.30)	<0.001
<i>Occupational</i>						
<i>Working offsite</i>						
No					1	
Yes					1.43 (1.14 to 1.80)	0.002
<i>Annual salary (\$)</i>						
<20K	1		1		1	
20–29K	1.11 (0.81 to 1.54)	0.513	0.98 (0.51 to 1.88)	0.952	1.67 (0.98 to 2.82)	0.057
30–39K	1.18 (0.93 to 1.52)	0.180	1.70 (0.88 to 3.28)	0.112	1.88 (1.02 to 3.44)	0.041
40–49K	1.53 (1.16 to 2.02)	0.003	2.07 (1.05 to 4.08)	0.035	1.75 (0.93 to 3.30)	0.082
50–59K	1.71 (1.27 to 2.31)	<0.001	2.34 (1.17 to 4.65)	0.016	1.95 (1.02 to 3.72)	0.043
>60K	1.74 (1.24 to 2.43)	0.001	3.23 (1.63 to 6.42)	0.001	2.97 (1.56 to 5.67)	0.001
<i>Availability of alcohol at work</i>						
High	1					
Low	1.28 (1.10 to 1.49)	0.001				
<i>Workgroup size</i>						
Number of people (increments of 10)	0.97 (0.96 to 0.99)	0.002				
<i>Design effects</i>						
<i>Worksite dominant occupation</i>						
Professional	1		1		1	
Service	1.47 (1.12 to 1.92)	0.005	1.02 (0.65 to 1.59)	0.930	0.58 (0.38 to 0.87)	0.008
Manufacturing	0.99 (0.76 to 1.28)	0.928	1.11 (0.79 to 1.55)	0.563	0.64 (0.46 to 0.89)	0.008
<i>Management drinking tolerance</i>						
Liberal	1		1		1	
Conservative	1.06 (0.87 to 1.28)	0.520	1.20 (0.91 to 1.59)	0.204	0.73 (0.55 to 0.97)	0.032
<i>Variance terms 2nd level</i>						
Empty model† Ω (SE)	0.138 (0.040)		0.281 (0.080)		0.325 (0.082)	
Covariate model‡ Ω (SE)	0.044 (0.026)		0.132 (0.058)		0.181 (0.062)	
Final model§ Ω (SE)	0.019 (0.021)		0.087 (0.051)		0.121 (0.052)	

*Quartile ranges: 1st 2.58–2.77, 2nd 2.78–2.93, 3rd 2.94–3.03, 4th 3.04–3.36.

†Intercept + design variables.

‡Intercept + design variables + covariates.

§Intercept + design variables + covariates + group social norms.

using the lowest quartile as the reference. An additional analysis was done treating workgroup norms as a continuous.

After the model was fitted to the data, odds ratios (ORs) and 95% CIs for unit increases were calculated. Given that level 1 residuals are not calculated in logistic regression multilevel models, the evaluation of fit for final models was conducted by assessment of level 2 residuals through examination of plots of normal scores compared with standardised residuals and normal scores histograms. A small departure from normality was observed in the residuals for frequent drinking, but it was not considered to affect adversely the analysis owing to the relatively large number of observations at level 2. All multilevel analyses were conducted using MLwiN 2.02, while covariate selection was completed using STATA 9.1.

RESULTS

Table 1 shows sample characteristics. Nineteen per cent of the workers ($n = 1015$) were classified as heavy drinkers, 8% as frequent drinkers ($n = 423$), and 11% as drinking at work ($n = 577$). Supervisory workgroup size varied from two to 215 workers (median 26 workers). Figure 1 presents workgroup level scatter plots of the prevalence of drinking behaviours within the 137 workgroups against drinking social norms. The percentages of the various drinking behaviours decrease as social norms increase.

Multilevel logistic analyses, adjusted for design variables (table 2), showed that discouraging drinking social norms were associated with a protective trend in the odds of heavy drinking, frequent drinking and drinking at work. Participants in the most discouraging quartile were 62% less likely to drink heavily, 64% less likely to drink frequently and 80% less likely to drink at work than their counterparts in the most encouraging quartile. Using workgroup drinking social norms as a continuous variable similar trends were observed, with reductions in heavy drinking (OR = 0.07, 95% CI 0.04 to 0.12), frequent drinking (OR = 0.05, 95% CI 0.02 to 0.11) and drinking at work (OR = 0.02, 95% CI 0.01 to 0.05).

After multivariate adjustment (table 3), the protective trend for discouraging norms towards drinking remained. Workers in the fourth quartile were 45% less likely to be heavy drinkers, 54% less likely to be frequent drinkers and 69% less likely to drink at work than their counterparts in the first quartile. Models using workgroup drinking social norms as a continuous variable generated similar results with reduced odds for heavy drinking (OR = 0.16, 95% CI 0.08 to 0.33), frequent drinking (OR = 0.10, 95% CI 0.04 to 0.23) and drinking at work (OR = 0.06, 95% CI 0.02 to 0.14).

Covariates included in multivariate models behaved as expected (table 3). Women, workers frequently attending religious services and people cohabiting were less likely to drink. Also, younger workers and workers who smoked were more likely to drink. Different covariate patterns were observed for each outcome (table 3), providing additional evidence of the independence of the drinking behaviours—that is, each outcome captured a different type of behaviour.

DISCUSSION

Workers belonging to a workgroup with discouraging drinking norms are less likely to drink heavily, frequently or at work after a wide range of potential covariates have been controlled. Notably, while the observed association is stronger for drinking at work, workgroup norms are also strongly associated with decreased odds for drinking behaviours outside the work environment, suggesting the potential long reach of worksite-based public health campaigns.

This study supports and extends previous research observing associations between workgroup norms and drinking at work.

Delaney⁷ and Ames⁶ observed associations between drinking norms and workplace drinking in American companies. In Taiwan, Yang *et al* observed a significant association between encouraging drinking subcultures and increased alcohol consumption.⁸

To our knowledge, this is the first study using a multilevel design and analysis with group level social norms measures. To extend the generalisation of previous norms research,³⁰ our study was conducted in a wide range of organisations with different dominant occupations and managerial attitudes towards drinking. Importantly, the level 2 sample of 137 workgroups was large. Our study significantly adds to earlier research^{6–8} restricted to a few worksites and workgroups without measures of norms at the workgroup level. Also, we included measures of two general (frequent and heavy drinking) and one work-related (drinking at work) drinking behaviour. Contrary to previous research, the drinking social norms scale used in the present study was constructed towards a restrictive (ie, discouraging drinking) rather than unrestricted (ie, encouraging drinking) direction, supporting a primary prevention model.

Some study limitations must be noted. First, the cross-sectional design precludes the disentanglement of temporal relations between social norms and drinking. Self-selection of drinkers to workplaces that encourage drinking might produce clusters of workers with similar drinking beliefs, which in a cross-sectional design could be interpreted as drinking social norms. Our study shows, however, that workgroup drinking norms remain associated with drinking after controlling for alcohol availability at the workplace and managerial tolerance to alcohol, two main characteristics that drink-seeking workers may consider when selecting a job.

Second, the time lag from survey implementation to data analysis might limit external validity. However, the major American workplace alcohol control policy, the 1988 Drug-free Workplace Act, was implemented 6 years before the survey. Since then, no other major modifications to workplace drinking or social drinking regulations have occurred. Therefore, the findings are unlikely to be threatened.

Third, a common criticism of aggregated measures in multilevel analysis is that aggregated measures capture individual and not group characteristics.³² Raudenbush's compositional effects test suggests the presence of an aggregate level exposure (ie, workgroup norms) operating independently of the individual exposure (ie, perceived beliefs). Furthermore, the $r_{wg(j)}$ index supports homogeneity of norms within groups. Together, these findings increase our confidence that the observed effect is at the workgroup level.

Finally, the strong associations found might be attributed to model misspecification.³³ To reduce the chance for model misspecification, final model estimates were adjusted for a wide range of known drinking risk factors, such as gender, age, education, salary, alcohol, family history and religious service attendance. An evaluation of workgroup drinking social norms as a categorical and continuous variable was conducted to ensure results were not due to exposure misclassification during the analysis. Both approaches gave similar results. Also, central constructs from other potential workplace pathways associated with drinking were included: workplace alcohol availability, drinking managerial tolerance, and potential sources of stress such as having more than one job, working on a hazardous environment, job insecurity, high job demands or low job control. Therefore, our findings are unlikely to be due to model misspecification.

Further prospective multilevel research is required to demonstrate a causal relationship between drinking social norms and drinking. Observational measures of workgroup

Main messages

- This study extends previous research by using a larger range of organisations with different dominant occupations and managerial attitudes towards drinking.
- Worksite social context is assessed, rather than individually perceived norms.
- Workgroup norms discouraging drinking reduce the likelihood of both non-work- (ie, heavy and frequent drinking) and work-related (ie, drinking at work) drinking behaviours.

Policy implications

- The workplace normative context is crucial for changing drinking behaviours and preventing abusive drinking.
- Development of alcohol prevention interventions should target group-based norms instead of individuals' beliefs.
- Worksite based social interventions may have the potential to affect health behaviours outside the workplace.

drinking social norms should be developed to eliminate threats posed by self-reported compositional measures. Whereas worksite preventive research has focused on health promotion at the individual level and occupational health research has focused on health protection activities, the current study suggests the importance of worksite-based social interventions as broad-based public health campaigns.

Human participants protection

The Harvard School of Public Health Institutional Review Board approved the study protocol.

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