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Workplace alcohol harm reduction intervention in Australia: Cluster non-randomised controlled trial

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Abstract

Introduction and Aims. *The workplace holds substantial potential as an alcohol harm reduction and prevention setting. Few studies have rigorously examined strategies to reduce workplace alcohol-related harm. Hence, an in-situ 3 year trial of a comprehensive alcohol harm reduction intervention in Australian manufacturing workplaces was undertaken.* ***Design and Methods.*** *Informed by a gap analysis, a multi-site trial was undertaken. Three manufacturing industry companies, located at four separate worksites, with a minimum of 100 employees were recruited through a local industry network. Based on worksite location, two worksites were allocated to the intervention group and two to the comparison group. The pre-specified primary outcome measure, risky drinking (Alcohol Use Disorders Identification Test, AUDIT-C) and other self-report measures were collected pre-intervention (T1), 12 months (T2) and 24 months post-intervention (T3).* ***Results.*** *No significant intervention effect was observed for the primary outcome measure, risky drinking. Significant intervention effects were observed for increased awareness of alcohol policy and employee assistance. At T3, the odds of intervention group participants being aware of the workplace policy and aware of employee assistance were 48.9% (95% confidence interval 29.3–88.9%) and 79.7% (11.5%, 91.8%), respectively, greater than comparison group participants.* ***Discussion and Conclusions.*** *Comprehensive tailored workplace interventions can be effective in improving workplace alcohol policy awareness. This is one of few workplace alcohol trials undertaken to-date and the findings make an important contribution to the limited evidence base for workplace alcohol harm prevention initiatives.* [Pidd K, Roche A, Cameron J, Lee N, Jenner L, Duraisingam V. Workplace alcohol harm reduction intervention in Australia: Cluster non-randomised controlled trial. *Drug Alcohol Rev* 2018]

Key words: workplace, alcohol, intervention, evaluation, harm reduction.

Introduction

Internationally, alcohol consumption is a leading risk factor for injury and disease [1,2] and there is increasing interest in effective population-level interventions to reduce consumption and related health/social harm [3]. One ideal prevention setting that has received comparatively little attention is the workplace. Most drinkers are employed and the workplace offers access to individuals who may not otherwise be exposed to prevention and intervention efforts.

Workforce alcohol-related harm has also attracted growing attention internationally [4–6]. Employees' alcohol use is associated with workplace injuries and absenteeism [6–8]. In Australia, alcohol use contributes to 11% of workplace accidents/injuries [8] and alcohol-related absenteeism costs employers approximately $AUS2 billion each year [9]. Less quantifiable negative effects such as presenteeism, productivity [10] and co-worker well-being [11] also have implications for workplaces, individual workers and the wider community.

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Prevalence data indicate that risky alcohol use varies significantly among workforce groups, even after controlling for demographic variables, with riskier consumption higher among particular occupation and industry groups—underscoring the importance of targeting high-risk groups and workplace environment factors [12,13].

Variations in workforce alcohol consumption are consistent with theoretical explanations of workplace/employee alcohol use relationships. Pidd and Roche [14] proposed that both individual and workplace factors can contribute to a workplace culture of alcohol use reflecting:

- workplace customs (e.g. social networks, managerial practices);
- working conditions (e.g. physical conditions, working hours);
- workplace controls (e.g. levels of supervision, policies); and
- factors external to the workplace (e.g. individual and wider social norms).

These factors combine to create a workplace culture that can support or discourage risky drinking both at, and away from, the workplace [14]. Thus, effective workplace interventions may also reduce risky alcohol use in general. Despite this, relatively few good quality studies are available to inform workplace policy and practice [6,15].

Workplace alcohol harm reduction strategies trialed to-date include: brief interventions [16]; health promotion [17]; employee assistance programs [18] employee education and training [19] and alcohol testing [20].

While some brief interventions have been found to be ineffective in the workplace [16,21], health promotion and substance abuse prevention/intervention programs, in conjunction with an employee assistance program, can decrease risky drinking [17]. Employee assistance programs, which offer employer sponsored services to help employees with personal and family problems, can be effective [18] but generally only target referred/self-referred employees.

Evidence concerning workplace education and training is also mixed. Some studies have found education increased knowledge of alcohol-related risk, but did not change behaviour [19]. By contrast, an information and training program, 'Team Awareness', was found to reduce problem drinking and alcohol-related absenteeism [22]. Similarly the educational program 'Prevent' (a 2–3 day workshop for young workers) reduced quantity and frequency of alcohol consumption [23]. In general, systematic reviews of evaluation studies have concluded workplace alcohol testing has limited effectiveness [20,24].

Overall, evidence of workplace alcohol harm reduction strategies is limited and inconclusive [3,4,15,24–27] for two reasons. First, workplace interventions often comprise generic programs (e.g. health/well-being, employee assistance) and do not specifically target alcohol-related harm. Second, they tend to focus on changing individual behaviour with little attention to contributory workplace factors.

Few studies have evaluated workplace policies to reduce alcohol-related harm, and none have examined structural factors [25]. The current study aimed to address this research gap by evaluating whether a multifaceted comprehensive 'whole-of-workplace' approach incorporating strategies to address workplace structural, organisational, environment and social factors, outlined in Pidd and Roche's [14] cultural model, could reduce employees' risky drinking and alcohol-related harm. Four strategies were utilised:

1. a formal co-designed workplace alcohol policy;
2. employee education to raise awareness of the policy and alcohol-related harm;
3. training for supervisory staff to identify and respond to alcohol-related harm; and
4. a referral pathway that facilitated help seeking for alcohol-related problems.

These strategies have been identified as essential to any workplace response to alcohol-related harm [6,28]. However to-date, no study has evaluated this approach, nor has any study used this approach to target factors that contribute to the workplace culture of alcohol use.

Methods

Design

A quasi-experimental design was employed over a 3-year period. The researchers, in consultation with worksite management, allocated two worksites to the intervention group and two worksites to the comparison group (Figure 1). Data were collected pre-intervention (T1), 12-months post-intervention (T2) and 24-months post-intervention (T3). Ethics approval was provided by Anglicare Victoria's Research Ethics Committee. Participant consent was sought from both worksite management and individual employees.

Sample

Standard randomised controlled trial sample size calculations indicated 284 participants (141 for each

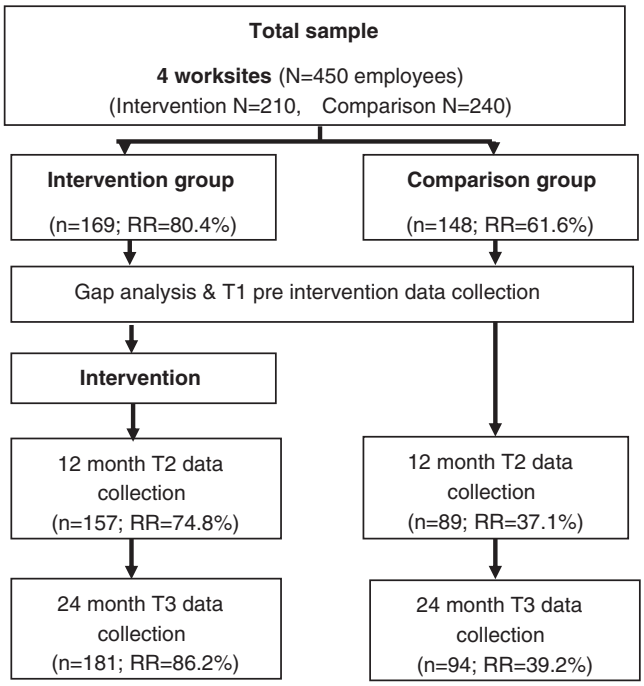

Figure 1. *Intervention evaluation study design. Note: RR= response rate*

group) were necessary to achieve a reduction of one in Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) scores, at a significance level of 0.05 and power of 80%. Previous research indicated a mean AUDIT-C score of 4.5 (SD = 3.0) for a general Australian population [29], a reduction of one in AUDIT-C scores was achievable and of clinical significance [30], and an intracluster correlation coefficient of 0.01–0.02 for health-related behaviours [31]. Using an intracluster correlation coefficient of 0.015 and an average cluster size of 100, cluster adjustment resulted in a total sample of 426.

The sample was drawn from three Australian manufacturing companies. Manufacturing is an industry with a high prevalence of risky alcohol use and related problems [12,32]. Recruitment occurred through a local industry network. The study rationale and aims were presented to network members at a regular network meeting and employers invited to participate in the study. Three companies that met the requirement of a minimum of 100 employees were recruited. One produced truck components and employed 200 workers at one location and 40 workers at a separate satellite worksite and was allocated to the comparison group. The two remaining companies were allocated to the intervention group. One produced plastic products and employed 110 workers at one worksite, all of whom were invited to participate. The other produced recreational vehicles and employed 1000 workers of whom 100 workers employed in one discrete section were invited to participate. All employees at both comparison worksites were eligible to participate, resulting in a potential sample of 450.

Measures

A purpose designed anonymous and confidential pen and paper survey was administered by researchers and completed by 317 employees during work hours three times, each approximately 12 months apart (T1, T2 and T3). Employees were informed of the study's rationale, aims and progress through regular workplace meetings and notice boards. The survey contained measures of age, gender, job role, ethnicity [non-English speaking background (NESB) and English speaking background (ESB)], alcohol use, related harm and attitude/knowledge measures, and took approximately 20 min to administer. All outcome variables were measured at the individual level.

Primary outcome measures

Alcohol use was assessed using the 3-item AUDIT-C [33]. A score of ≥4 is positive for at risk drinking/active alcohol abuse/dependence.

Secondary outcome measures

Attitudes toward alcohol use at work were assessed using a 4-item measure adapted from the European Alcohol Workplace and Alcohol Baseline Questionnaire [34], plus two purpose designed items ('*It's ok for workers to come to work with a hangover*' and '*How much I drink is a personal issue and should not be talked about in the workplace*'). Items were scored on a 1–5 scale (strongly agree—strongly disagree). Item scores were summed to give total alcohol and work attitude scores.

Alcohol and health knowledge was assessed using a 7-item measure adapted from the European Alcohol Workplace and Alcohol Baseline Questionnaire [34]. Items assessed perceptions of whether alcohol increased risk of different health conditions on a 1–5 scale (strongly agree—strongly disagree). Item scores were summed to give total alcohol and health knowledge scores.

Alcohol-related harm in the workplace was assessed by 6-items specifically developed for the study. Respondents were asked to indicate if in the past 3 months they had: (i) attended work with a hangover; (ii) arrived late due to drinking; (iii) taken a day off work due to their alcohol use; and how many times in the past 12 months a co-worker's alcohol use had

resulted in them; (iv) covering for the co-worker; (v) working extra hours; and (vi) being involved in an accident/close call at work.

Policy awareness: respondents were asked if: (i) their workplace had an alcohol policy (yes/no/do not know); (ii) a workplace alcohol policy was a good idea (yes/no); and (iii) their employer provided a support service, or access to a support service, for employees with alcohol problems (yes/no/do not know).

Statistical analyses

Data were analysed using Statistical Package for the Social Sciences (SPSS) V22.0 software. Data were subjected to Little's MCAR test [35] and missing values replaced using the Maximum Likelihood Estimation (MLE) method. To test the assumptions of missing at randomness complete case analyses were also conducted (See supplementary tables S1 and S2). In all cases, the results of complete case analyses were qualitatively the same as the analyses using the MLE approach and as such only the analyses using the MLE approach are presented. The only exception to this was for T3 between group differences in policy awareness, as described in the results.

Between group differences at T1 and within group differences T1–T2–T3, were examined using independent *t*-tests for continuous variables and χ^2 tests for binary variables. Significance levels were adjusted using the corrected False Discovery Rate method [36] and further corrected for cluster effects using recommend equations for: (i) adjusted t tests [37]; and (ii) adjusted χ^2 tests [38].

Between group differences in continuous outcomes at T2 and T3 were analysed using negative binomial regressions, with results reported as percentage difference in means. Between group differences in categorical outcomes at T2 and T3 were analysed using binary logistic regressions, with results reported as percentage differences in odds.

The intervention

The development and implementation of the intervention was informed by a gap analysis involving pre-intervention (T1) survey data, 47 key informant interviews and eight site observations (reported elsewhere). A gap analysis is defined as a technique to identify factors that need to be addressed in order to move from a current to desired state, and involves a risk and needs assessment. The gap analysis revealed high-stress, fast-paced shift work, long hours, low-level policy awareness, variability in managers' and supervisors' ability to manage alcohol-related risk, and identified risk and protective factors relevant to the proposed cultural model [14].

The intervention comprised a whole-of-workplace approach, was co-developed with all workplace stakeholders, and incorporated into existing workplace processes to maximise uptake, acceptability and sustainability. The intervention was delivered at the group and individual levels and comprised: (i) a formal workplace alcohol policy; (ii) an employee education/awareness program; (iii) a supervisor/manager training program; and (iv) an employee referral pathway. These intervention components were implemented in four sequential stages over a 12 month period.

Component 1: Workplace alcohol policy and procedural guidelines. Workshops were conducted with supervisory staff to ensure content and implementation matched workplace environments and organisational structures. The policy detailed rationale and aims, restrictions on workplace alcohol and drug use, and roles and responsibilities of employers and employees. Resources were developed to assist implementation, including policy posters, flyers and information sheets.

Component 2: A 20-min employee training program to raise employees' awareness of the policy, local community services and alcohol-related health/safety issues was delivered at times to fit with production demands, and was embedded within new employee induction training.

Component 3: A 90-min supervisor training program to enhance supervisory staff capacity to implement the policy and referral procedures and respond to alcohol-related harm. Training included demonstrations and coaching to build capacity to address alcohol well-being topics within normal workplace communication processes.

Component 4: A referral pathway guideline was developed to assist managers/supervisors identify local alcohol and drug, community health and welfare organisations for employees in breach of the policy or who sought help for alcohol-related issues. A Local Area Resource Guide was also developed for employees.

These four components targeted factors identified in the project's underpinning cultural model of employee alcohol use [14]. Development of a formal policy introduced a workplace control mechanism to restrict work-related alcohol use. Supervisor/manager training increased workplace controls by building supervisors' capacity to implement the policy and identify affected employees, and improved supervisors' understanding of the relationship between working conditions and consumption patterns. Employee awareness sessions targeted existing workplace customs and practices, individual behaviours and beliefs, and awareness of contributory workplace factors. The referral pathways guide established a workplace managerial process for dealing

Table 1. *Demographic characteristics of study sample pre-intervention (T1)*

	All (n = 317)	Intervention (n = 169)	Comparison (n = 148)
Age, years- M (SD)	37.4 (12.0)	38.0 (12.4)	36.7 (11.5)
Male, N (%)	277 (87.4)	138 (81.9)	126 (85.1)
NESB, N (%)	125 (39.4)	57 (33.8)	78 (53.8)[a]
Job role, N (%)			
Supervisor/manager	24 (7.6)	17 (10.3)	7 (4.5)
Team leader	21 (6.6)	13 (7.7)	8 (5.2)
Admin/office	12 (3.8)	7 (3.9)	5 (3.7)
Trades/professional	68 (21.5)	32 (18.7)	36 (24.6)
Semi-skilled/labourer	192 (60.6)	100 (59.4)	92 (61.9)

[a]Significant intervention/comparison group difference, P = 0.001. NESB, non-English speaking background.

with affected workers and a method of enabling individual behaviour change through treatment/counselling.

Program fidelity

To maximise program fidelity, initial employee awareness sessions were conducted or monitored by the researchers.

Results

Study sample

Of the 450 employees invited to participate 317 - (response rate = 70.4%), (169 intervention response rate = 80.4% and 148 comparison response rate = 61.6%), completed the T1 pre-intervention survey. Mean age was 37.4 years (range = 17–67), 87.4% were male and 39.4% were NESB participants (Table 1). Intervention and comparison group demographic profiles were similar. However, the comparison group had significantly more NESB participants (x^2 = 11.04, P = 0.001).

Age was negatively correlated with pre-intervention AUDIT-C scores (r = −0.184, P = 0.002) and positively associated with usually drinking ≥5 standard drinks (t(281) = 3.7, P < 0.001). NESB workers had significantly lower AUDIT-C scores (t(292) = 7.0, P < 0.001), were less likely to usually drink ≥5 standard drinks (x^2 = 29.0, P < 0.001) or drink weekly or more often (x^2 = 17.1, P < 0.001). No other workforce or occupational demographics were associated with outcome variables.

Baseline data

At pre-intervention, 47.0% had positive AUDIT-C scores (≥4). At T1, intervention participants had significantly higher mean AUDIT-C scores and significantly more usually drank ≥5 standard drinks, or drank weekly or more often. However, after adjusting for cluster effect and multiple comparisons, these differences were not significant (Table 2).

Intervention outcomes

No significant intervention effects were observed for the primary outcome measure—risky drinking (AUDIT-C). However, significant intervention effects were observed for two secondary outcome measures—alcohol policy and employee assistance awareness.

Post-intervention (T2) and post-intervention follow up (T3)

A substantial proportion of completed surveys could not be matched despite a required unique ID code. Hence, data were analysed at the aggregate, rather than individual, level. Post-hoc analyses indicated no significant differences in demographics between the intervention and comparison groups at T2 or T3.

A total of 264 (157 intervention and 89 comparison) employees completed the T2 survey (total response rate = 58.7%; intervention group = 74.8%; comparison group = 37.1%) and 275 (181 intervention and 94 comparison) completed the T3 survey (total response rate = 61.1%; intervention group = 86.2%; comparison group = 39.2%).

Post-intervention (T2) between group differences

At T2 there were significant between group differences in AUDIT-C scores, usually drinking ≥5 standard drinks, policy awareness, policy support and awareness

Table 2. *Pre-intervention (T1) alcohol harm measures*

	All (n = 317)	Intervention (n = 169)	Comparison (n = 148)
Individual measures			
Mean alcohol and health knowledge score, M (SD)	32.0 (6.6)	32.1 (6.2)	31.8 (7.2)
Mean alcohol and work attitude score, M (SD)	24.0 (7.0)	24.2 (7.3)	23.8 (6.5)
Mean AUDIT-C score, M (SD)	3.8 (3.4)	4.2 (3.5)	3.4 (3.1)
AUDIT-C score ≥4, N (%)	149 (47.0)	87 (51.5)	62 (41.9)
Drinking weekly or more often[a], N (%)	100 (31.5)	62 (48.1)	38 (33.3)
Usually drink ≥5 standard drinks[a], N (%)	83 (26.2)	54 (30.9)	29 (19.6)
Workplace measures, N (%)			
Came to work with hangover	82 (25.9)	51 (32.0)	31 (20.9)
Day off due to alcohol use	7 (2.2)	6 (3.6)	1 (0.7)
Came to work late due to hangover	23 (7.3)	9 (5.3)	14 (9.5)
Covered for co-worker due to their alcohol use	17 (5.4)	11 (6.5)	6 (4.1)
Worked extra hours due to co-worker alcohol use	28 (8.8)	11 (6.5)	17 (11.5)
Accident/near miss due to co-worker alcohol use	15 (4.7)	10 (5.9)	5 (3.4)
Policy measures, N (%)			
Aware of current policy	202 (63.7)	101 (59.8)	101 (68.2)
Support for workplace policy	241 (76.0)	124 (73.4)	117 (79.1)
Aware of employee assistance	55 (17.4)	28 (16.1)	27 (18.2)

[a]Current drinkers only. AUDIT-C, Alcohol Use Disorders Identification Test-Consumption.

of employee assistance (Table 3). Mean AUDIT-C scores for the intervention group were 47.3% higher than the comparison group and the odds of intervention group participants usually drinking ≥5 standard drinks was 181.0% higher than comparison participants. The odds of intervention group participants being aware of the workplace policy, supporting the policy, and being aware of employee assistance were 41.5, 28.9 and 45.7%, respectively, higher than comparison group participants.

Post-intervention follow up (T3) between group differences

At T3 there were significant between group differences in awareness of employee assistance (Table 4). The odds of intervention group participants being aware of employee assistance were 82.9% higher than comparison group participants. Complete case data analyses also revealed a significant (P = 0.02) intervention effect for policy awareness, with the odds of intervention group participants being aware of employee assistance 48.9% higher than comparison group participants (Table S2).

Within group T1–T3 changes in alcohol harm measures

After cluster effect and multiple comparison adjustment, there was a significant T1–T2 and T1–T3 increase in the proportion of intervention group participants aware of employee assistance and a significant T1–T3 increase in the proportion aware of the workplace alcohol policy (Table 5). Absolute risk reduction calculations indicated a 19.1% [95% confidence interval (CI) 9.6–28.3%] T1–T2 increase and a 43.5% (95% CI 33.5–51.5%) T1–T3 increase in employee assistance awareness, and a 22.0% (95% CI 12.5–31.0%) T1–T3 increase in policy awareness among intervention group participants. There were no significant (adjusted) T1–T2 or T1–T3 changes in outcome measures for the comparison group (Table 6).

Post-hoc analyses

Given the association between ethnicity (NESB/ESB) and AUDIT-C, post-hoc analysis was undertaken excluding NESB participants. Results similar to the total sample were observed. There was a significant (adjusted) increase in the proportion of intervention group participants aware of the alcohol policy (x^2 = 6.1, P = 0.01) or employee assistance (x^2 = 24.9, P < 0.001). By contrast, there was no significant (adjusted) T1–T3 change in these measures for the comparison group.

In order to control for the unequal group samples at T1 and T3, post-hoc analyses were also undertaken on a random selection of participants (using SPSS 'SELECT IF RANDOM' syntax), allowing for an equal number of intervention and comparison group participants at T1 and T3 to be analysed. Similar results to those obtained using unequal sample sizes

Table 3. *Post-intervention (T2) alcohol harm measures*

	Intervention (n = 157)	Comparison (n = 89)	Percentage difference in mean or odds[a], % (95% CI)	P
Individual measures				
Mean alcohol and health knowledge score, M (SD)	32.3 (5.9)	31.4 (7.2)	2.9% (−1.8%, 7.5%)	0.22
Mean alcohol and work attitude score, M (SD)	23.4 (6.5)	25.6 (6.5)	8.8% (−35.3%, 17.7%)	0.52
Mean AUDIT-C score, M (SD)	4.1 (3.1)	2.6 (2.8)	47.3% (16.9%, 77.7%)	0.002
Drinking weekly or more often[b], N (%)	60 (48.4)	21 (38.9)	47.3% (−23.1%, 182.4%)	0.24
Usually drink ≥5 standard drinks[b], N (%)	40 (26.5)	10 (11.4)	181.0% (32.6%, 495.7%)	0.007
Workplace measures, N (%)				
Came to work with hangover	37 (23.6%)	14 (15.7%)	65.2% (−16.3%, 225.8%)	0.15
Day off due to alcohol use	3 (1.9%)	2 (2.2%)	15.3% (−86.1%, 417.0%)	0.86
Came to work late due to hangover	6 (3.8%)	4 (4.5%)	15.6% (−76.8%, 207.6%)	0.80
Covered for co-worker due to their alcohol use	4 (2.5%)	2 (2.2%)	12.1% (−84.2%, 390.0%)	0.88
Worked extra hours due to co-worker alcohol use	7 (4.5%)	9 (10.1%)	141.0% (−13.4%, 571.0%)	0.09
Accident/near miss due to co-worker alcohol use	2 (1.3%)	4 (4.5%)	264.7% (−34.6, 1932.0%)	0.14
Policy measures, N (%)				
Aware of current policy	116 (73.9)	41 (46.1)	41.4% (23.9%, 71.6%)	0.002
Support for a workplace policy	136 (86.6)	58 (65.2)	28.9% (15.3%, 55.4%)	<0.001
Aware of employee assistance	56 (35.7)	18 (20.2)	45.7% (24.8, 84.3%)	0.012

[a]Intervention compared to control. Difference in mean by negative binomial regression: mean alcohol and health knowledge score, mean alcohol and work attitude score, mean AUDIT-C score. Difference in odds by logistic regression: drinking weekly or more often, usually drink ≥5 standard drinks, came to work with hangover, day off due to alcohol use, came to work late due to hangover, covered for co-worker due to their alcohol use, worked extra hours due to co-worker alcohol use, accident/near miss due to co-worker alcohol use, aware of current policy, support for a workplace policy, aware of employee assistance. [b]Current drinkers only. AUDIT-C, Alcohol Use Disorders Identification Test-Consumption; CI, confidence interval.

Table 4. *Post-intervention follow up (T3) alcohol harm measures*

	Intervention (n = 181)	Comparison (n = 94)	Percentage difference in mean or odds[a], % (95% CI)	P
Individual measures				
Mean alcohol and health knowledge score, M (SD)	33.1 (6.2)	33.5 (6.9)	1.2% (−23.2%, 27.3%)	0.93
Mean alcohol and work attitude score, M (SD)	23.6 (6.8)	25.2 (8.3)	6.5% (−27.5%, 20.6%)	0.94
Mean AUDIT-C score, M (SD)	3.5 (2.9)	2.7 (2.7)	28.5% (−3.7%, 71.5%)	0.09
Drinking weekly or more often[b], N (%)	59 (42.8)	22 (35.5)	35.8% (−27.0%, 152.4%)	0.33
Usually drink ≥5 standard drinks[b], N (%)	34 (18.8)	13 (13.8)	44.1% (−28.0%, 188.6%)	0.30
Workplace measures, N (%)				
Came to work with hangover	36 (19.9)	19 (20.2)	2.6% (−47.4%, 82.5%)	0.95
Day off due to alcohol use	3 (1.7)	1 (1.1)	56.7% (−83.9%, 1427.9)	0.70
Came to work late due to hangover	8 (4.4)	4 (4.3)	4.0% (69.5%, 254.9%)	0.95
Covered for co-worker due to their alcohol use	9 (5.0)	2 (2.1)	58.7% (−91.3%, 95.2%)	0.26
Worked extra hours due to co-worker alcohol use	9 (5.0)	5 (5.3)	6.7% (−65.3%, 228.1%)	0.91
Accident/near miss due to co-worker alcohol use	4 (2.2)	1 (1.1)	52.4% (−94.8%, 331.8%)	0.51
Policy measures, N (%)				
Aware of current policy	148 (81.8)	69 (73.4)	6.8% (−29.0%, 15.8%)	0.55
Support for a workplace policy	157 (86.7)	76 (80.9)	5.1% (−27.9%, 18.2%)	0.60
Aware of employee assistance	108 (59.7)	19 (20.2)	82.9% (69.3%, 90.5%)	<0.001

[a]Intervention compared to control. Difference in mean by negative binomial regression: mean alcohol and health knowledge score, mean alcohol and work attitude score, mean AUDIT-C score. Difference in odds by logistic regression: drinking weekly or more often, usually drink ≥5 standard drinks, came to work with hangover, day off due to alcohol use, came to work late due to hangover, covered for co-worker due to their alcohol use, worked extra hours due to co-worker alcohol use, accident/near miss due to co-worker alcohol use, aware of current policy, support for a workplace policy, aware of employee assistance. [b]Current drinkers only. AUDIT-C, Alcohol Use Disorders Identification Test-Consumption; CI, confidence interval.

Table 5. *T1–T3 intervention group changes in alcohol harm measures*

	T1	T2	T1–T2	Sig[a]	Sig[b]	T3	T1–T3	Sig[a]	Sig[b]
Individual measures									
Mean alcohol and health knowledge score	32.1	32.3	+0.2	NS	NS	33.1	+1.1	NS	NS
Mean alcohol and work attitude score	24.2	23.4	−0.8	NS	NS	23.6	−0.6	NS	NS
Mean AUDIT-C score[c]	4.2	4.1	−0.1	NS	NS	3.5	−0.7	NS	NS
Drinking weekly or more often[c]	48.1%	48.4%	+0.3%	NS	NS	42.8%	−5.3%	NS	NS
Usually drink ≥5 standard drinks[c]	30.9%	26.5%	−4.4%	NS	NS	18.8%	−12.1%	NS	NS
Workplace measures									
Came to work with hangover	32.0%	23.6%	−8.4%	NS	NS	19.9%	−12.1%	NS	NS
Day off due to alcohol use	3.6%	1.9%	−1.7%	NS	NS	1.7%	−1.9%	NS	NS
Came to work late due to hangover	5.3%	3.8%	−1.5%	NS	NS	4.4%	−0.9%	NS	NS
Covered for co-worker due to their alcohol use	6.5%	2.5%	−4.0%	NS	NS	5.0%	−1.5%	NS	NS
Worked extra hours due to co-worker alcohol use	6.5%	4.5%	−2.0%	NS	NS	5.0%	−1.5%	NS	NS
Accident/near miss due to co-worker alcohol use	5.9%	1.3%	−4.6%	NS	NS	2.2%	−3.7%	NS	NS
Policy measures									
Aware of current policy	59.8%	73.9%	+14.1%	NS	NS	81.8%	**+22.0%**	$x^2 = 6.6$, $P = 0.01$	p = .001 ($q^* < .005$)
Support for a workplace policy	73.4%	86.6%	+13.2%	NS	NS	86.7%	+13.3%	NS	NS
Aware of employee assistance	16.1%	35.7%	+19.6%	$x^2 = 8.2$, $P = 0.004$	p = .004 ($q^* < .005$)	59.7%	**+43.6%**	$x^2 = 31.6$, $P < 0.001$	p = .01 ($q^* < .011$)

[a]Adjusted for cluster effect. [b]Benjamini and Hochberg [36] corrected False Discovery Rate (q^*). [c]Current drinkers. AUDIT-C, Alcohol Use Disorders Identification Test-Consumption; NS, not significant.

Table 6. *T1–T3 comparison group changes in alcohol harm measures*

	T1	T2	T1–T2	Sig[a]	Sig[b]	T3	T1–T3	Sig[a]	Sig[b]
Individual measures									
Mean alcohol and health knowledge score	31.8	31.4	−0.04	NS	NS	33.5	+1.7	NS	NS
Mean alcohol and work attitude score	23.8	25.6	+1.8	NS	NS	25.2	+1.4	NS	NS
Mean AUDIT-C score[c]	3.4	2.5	−0.9	NS	NS	2.7	−0.7	NS	NS
Drinking weekly or more often[c]	33.7%	38.9%	+5.2%	NS	NS	35.5%	+1.8%	NS	NS
Usually drink ≥5 standard drinks[c]	19.6%	11.4%	+8.2%	NS	NS	13.8%	−5.8%	NS	NS
Workplace measures									
Came to work with hangover	20.9%	15.7%	−5.2%	NS	NS	20.2%	+0.7%	NS	NS
Day off due to alcohol use	0.7%	2.2%	+1.5%	NS	NS	1.1%	+0.4%	NS	NS
Came to work late due to hangover	9.5%	4.5%	−5.0%	NS	NS	4.3%	−5.2%	NS	NS
Covered for co-worker due to their alcohol use	4.1%	2.2%	−1.9%	NS	NS	2.1%	−2.0%	NS	NS
Worked extra hours due to co-worker alcohol use	11.5%	10.1%	−1.4%	NS	NS	5.3%	−6.2%	NS	NS
Accident/near miss due to co-worker alcohol use	3.4%	4.5%	+1.1%	NS	NS	1.1%	−2.3%	NS	NS
Policy measures									
Aware of current policy	68.2%	46.1%	+14.2%	NS	NS	73.4%	+5.2%	NS	NS
Support for a workplace policy	79.1%	65.2%	−13.9%	NS	NS	80.9%	+1.8%	NS	NS
Aware of employee assistance	18.2%	20.2%	+2.0%	NS	NS	20.2%	+2.0%	NS	NS

[a]Adjusted for cluster effect. [b]Benjamini and Hochberg [36] corrected False Discovery Rate. [c]Current drinkers only. AUDIT-C, Alcohol Use Disorders Identification Test-Consumption; NS, not significant.

were found. There was a significant (adjusted) increase in proportion of intervention group participants aware of the alcohol policy ($x^2 = 6.2$, $P = 0.01$) or employee assistance ($x^2 = 21.1$, $P < 0.001$). By contrast, there was no significant (adjusted) change in comparison group outcome measures.

Discussion

This study is one of few trials undertaken internationally to evaluate an in-situ workplace alcohol harm reduction intervention. The 3 year trial did not produce any significant reduction in the main outcome measure (AUDIT-C). There were no significant between group differences in risky alcohol use at post-intervention follow up (T3). Contrary to expectations, post-intervention (T2) results indicated that the intervention group had higher AUDIT-C scores and levels of heavy drinking (≥5 standard) than the comparison group. The reasons for this unexpected result are unclear. It may be due to seasonal changes in drinking patterns as within group analyses indicated non-significant T1–T2 increases in risking drinking measures for both groups. As intervention group participants had higher levels of risky drinking at baseline, seasonal increases in risky drinking may have been more pronounced among this group.

Intervention effects were observed for two secondary outcome measures—employee assistance awareness and policy awareness. At post-intervention (T2) and post-intervention follow up (T3) intervention group participants were significantly more likely than comparison participants to be aware of employee assistance for alcohol problems. At post-intervention (T2) intervention group participants were significantly more likely than comparison participants to be aware of the workplace alcohol policy, with less conservative complete case analysis indicating a similar result at T3. These results were supported by within group analysis that indicated increases in awareness were evident with the intervention group only. This finding is particularly important as workplace policy awareness is not only associated with employees' alcohol consumption patterns [39], but also with help seeking for alcohol-related problems [40].

While the approach adopted was not effective in reducing risky alcohol use, the effect on raising policy awareness may be due to the comprehensive, co-design approach adopted. Key stakeholder interviews and policy development workshops were conducted to assist with the gap analysis and policy development, and also utilised as a tool for leadership and frontline worker engagement. The intervention development and implementation involved a comprehensive 'whole-of-workplace' approach. All employees were involved and emphasis placed on well-being of both individual employees and the workplace. Emphasis was also placed on incorporating intervention strategies into existing day-to-day workplace processes to maximise uptake and ensure sustainability. Thus, while limited, the results of the current study are consistent with Australian [27] and international [41] research indicating that workplace interventions are more likely to be

effective if tailored to meet the needs and resources of specific workplace settings.

Study modification

The original study design involved a cluster randomised control trial. The original study design involved a cluster randomised control trial. However, randomisation of worksites could not be undertaken due to changes in worksite management and related logistical and production demands. As a result, a quasi-experimental design was employed, which could have limited findings by introducing selection bias. This change in study design may have also reduced power as a larger sample size would be necessary for a quasi-experimental design. This modification also highlights the inherent difficulty in conducting in-situ workplace trials, where organisational production demands take precedence over research considerations.

Despite finding no intervention effect for the main outcome measure (AUDIT-C), the study findings may indicate that workplace interventions do have potential for reducing alcohol-related harm. While not statistically significant, substantial T1–T3 reductions in the proportions of intervention group drinking weekly or more often, or usually drinking ≥5 drinks were observed. Such substantial T1–T3 declines were not observed in among comparison group participants. It could be argued that increased power with a much larger sample size may have resulted in a significant intervention effect for these measures of alcohol-related harm.

Study limitations

Input into study design and comparison between study intent and study outcomes was limited by a lack of prior published study protocol [42]. In addition, unequal sample sizes and comparatively low comparison group response rates may have introduced attrition bias. However, apart from significantly more NESB participants in the comparison group there were no other significant occupational or demographic differences between groups at T1, T2 or T3. While ethnicity was associated with measures of risky drinking, post-hoc analyses without NESB participants produced similar results to those obtained with the complete data set. Similarly, post-hoc analyses using equal sample sizes also produced similar results to those obtained using data from the unequal group sample.

Analyses were also limited to aggregated rather than matched sample data. While survey respondents were asked to provide unique ID codes, only 40 intervention and seven comparison group participants could be matched from T1–T2–T3. Participants may have been reluctant to provide accurate ID codes for fear of being identified regardless of assurances of anonymity and confidentiality. While use of aggregated, group level changes to infer individual behaviour change may result in an 'ecological fallacy' [43], use of individual self-report data as opposed to organisational level data reduces the risk of ecological fallacy occurring [44]. In addition, the study worksites reported <20% employee turnover rates during the trial, indicating most participants were constant at T1, T2 and T3.

Reluctance to provide ID codes and low response rates may also be due to lack of employee engagement. Intervention development and implementation involved frequent researcher visits to intervention sites which may have enabled employee-researcher familiarisation and rapport to be established. This was not the case at comparison sites and may explain the T1–T3 response rate increase among intervention sites and decline among comparison sites.

Use of self-report measures of alcohol consumption and related harm may also have led to under-reporting [45] and respondent's attribution of co-worker behaviour in regard to alcohol use may not be accurate. As the study involved only three small-medium sized manufacturing companies results may not generalise to other industries and larger workplaces. Replication studies are required in different settings and locations. This limitation notwithstanding, the study involved small-medium sized companies and most workers in Australia are employed in small-medium sized companies [46].

Conclusion

The results of this trial indicated that the intervention was not effective in reducing risky alcohol use, but was effective in raising awareness of the workplace alcohol policy and awareness of employee assistance for alcohol problems. The results also highlight the difficulties in conducting in-situ trials of workplace intervention. Despite the limitations of the current study, the findings make an important contribution to the small, but growing, evidence base concerning types of interventions likely to yield positive outcomes among workplace populations.

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Conflict of interest

The authors have no conflicts of interest.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

Table S1. Post-intervention (T2) alcohol harm measures (complete case analysis)
Table S2. Post-intervention follow-up (T3) alcohol harm measures (complete case analysis)