



A multi-faceted intervention to reduce alcohol misuse and harm among sportspeople in Ireland: a controlled trial

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Title: A multi-faceted intervention to reduce alcohol misuse and harm among sportspeople in Ireland: a controlled trial

Running title: Reducing alcohol-related harm in Irish sports clubs

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ABSTRACT

Introduction and aims: Alcohol misuse and harm are more prevalent amongst sportspeople than non-sportspeople. Few studies have trialled interventions to address alcohol misuse for this group. The study aimed to test the effectiveness of an intervention to reduce alcohol misuse and related harms among amateur sportspeople in Ireland.

Design and methods: A controlled trial was conducted in two counties in Ireland. A random selection of sports clubs in one county received a 4-month multi-faceted intervention. All sports clubs in a non-adjacent county acted as control sites. Consumption of more than 21 units of alcohol per week and 6 or more standard drinks on a single occasion at least once per week were the primary study outcomes. Alcohol Use Disorders Identification Test (AUDIT) scores and number of alcohol-related harms were also reported. Outcomes were assessed for cross-sectional samples of players at pre- and post-intervention and paired samples of players who completed surveys at both times. Generalized linear mixed model analysis was used.

Results: There was no evidence of effect for the primary outcomes or AUDIT scores. There was a statistically significant difference in the median number of alcohol-related harms reported by intervention group players compared to control group players at post-intervention for the paired samples (Intervention: 0; Control: 3; IRR 0.56 (0.37, 0.84); $P=0.005$).

Discussion and conclusions: Intervention in community sports clubs may be effective in reducing the number of alcohol-related harms. Low levels of intervention participation and inadequate intervention dose are possible reasons for lack of a broader intervention effect.

Key words: alcohol drinking; sport; intervention; controlled trial

INTRODUCTION

Ireland has a history of excessive alcohol consumption, with average annual consumption peaking in 2001 at 14.4 litres of pure alcohol per adult aged 15 years and over [1]. Although average annual consumption had fallen and stabilized at around 11 liters in 2013, this was almost 20% more than the Organisation for Economic Co-operation and Development average of 8.9 litres [2]. The prevalence of heavy episodic drinking in Ireland is also high [3]. In 2014-5, 57% of males and 21% of females who consumed alcohol drank six or more drinks on a typical drinking occasion, 41% indicated that they did so at least once a month, and 24% did so at least once a week [4].

The link between alcohol misuse, risk of alcohol-related harms and sport is well established, with people who participate in sport being more likely to engage in alcohol misuse than non-sportspeople [5, 6]. High levels of alcohol misuse have been found amongst amateur and professional sports people in several countries, including New Zealand [6], Australia [7], the United States [8] and Brazil [9]. People involved in team sports have been suggested to be at greater risk of alcohol misuse and alcohol-related harm than those involved in non-team sports [7, 10-12].

In Ireland, amateur Gaelic football and hurling players report high levels of alcohol consumption, heavy episodic drinking and alcohol-related harms. For instance, 54% of players have reported regular heavy episodic drinkers (≥ 6 drinks at least once a week) compared with 40% of males nationally [13]. Thirty per cent of such players also reported drinking more than the recommended weekly level of alcohol (21 units) compared with 15% nationally, whilst 32% reported involvement in a violent incident due to their drinking, compared with 15% nationally [13].

Community-level interventions have been shown to be effective in reducing alcohol related harm including drinking and driving, alcohol related traffic fatalities and assault injuries [14-17]. Successful interventions have employed a multi-faceted approach to the prevention of alcohol related harms and have focused on the community as a system involving the individual drinker, groups of drinkers and drinking environments [17].

Although the sport setting has potential for inclusion in such community-level interventions, a Cochrane systematic review on interventions implemented through sporting organisations

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3 to improve alcohol misuse and harms found no controlled trials [18]. Subsequent to this
4 review, only one randomised controlled trial of an alcohol-harm reduction intervention in
5 community sports clubs has been reported [19]. The trial was carried out in amateur football
6 clubs in Australia and involved a 2.5 year multi-faceted, socio-ecological intervention to
7 reduce risky alcohol consumption and alcohol related harms through changing club alcohol
8 management practices. The intervention was effective in reducing risky alcohol consumption
9 (5+ standard drinks (10g/alcohol) per occasion at least once a month) by club members whilst
10 at the club (Intervention: 19%; Control: 24%; OR: 0.63 (95% CI 0.40 to 1.00); $P=0.05$) and
11 risk of alcohol-related harm overall (AUDIT score ≥ 8 Intervention: 38%; Control: 45%; OR:
12 0.58 (95% CI 0.38 to 0.87); $p<0.01$)[19]. Given significant differences between countries in
13 the cultural, social and structural characteristics of sport, further research is required to
14 advance the evidence base by establishing whether such an intervention is effective in other
15 countries and for other sporting codes and could be rolled out by policy makers and sporting
16 bodies more broadly.
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28 This study aimed to assess the effectiveness of a multi-faceted intervention in reducing
29 alcohol consumption and risk of alcohol-related harms amongst Gaelic Athletic Association
30 (GAA) club players.
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33 34 35 **METHODS**

36 **Ethical approval**

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38 Ethical approval was obtained from the Research Ethics Committee of the Faculty of Public
39 Health Medicine of Ireland and the Royal College of Physicians in Ireland.
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42 43 **Study design and setting**

44 A cluster controlled trial was undertaken involving GAA clubs in two counties (one
45 intervention county, one control county) in the Republic of Ireland. To avoid contamination,
46 two counties with non-contiguous boundaries from two different provinces in Ireland were
47 selected and, of these, the county nearer to the study team was selected for intervention for
48 pragmatic reasons. The GAA is the largest amateur sporting and community organisation in
49 Ireland ($>2,000$ clubs/800,000 members) with clubs competing in Gaelic football and/or
50 hurling leagues and championships from January to September[20]. Clubs consist of junior,
51 intermediate and senior (including inter-county) players.
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Participant eligibility and recruitment

GAA clubs

All GAA clubs (n=29) in the control county and a random sample of 14 (20%) of the 70 GAA clubs in the intervention county were invited to participate. Random sampling of intervention clubs was undertaken as resource constraints meant that only 14 clubs could receive the intervention. However, to increase study power, all clubs within the control county were invited to participate. The random sequence for selecting intervention clubs was generated using a random-number generator in Microsoft Excel. Consent for clubs to participate in the study was obtained from GAA County Boards.

GAA players

All male club players aged 16 years and over who were currently playing with the club were eligible to participate, and injured players were excluded. A list of eligible players was provided by each club.

Intervention

The intervention was implemented over a four-month period and consisted of: (1) alcohol education for players; (2) alcohol education for coaches; (3) alcohol policy training for club managers and coaches; and (4) an awareness campaign. The intervention was based on successful, multi-faceted community based interventions for the reduction of alcohol-related harm [14-17], and included educational and environmental strategies targeting players, club management and the wider club community. See Table S1 for further detail. The intervention was delivered by trained health promotion personnel from the local health service provider (March to June 2008).

Control group

Players from both control and intervention group clubs received an education session on sports nutrition that did not include any alcohol-related content.

Data collection procedures and measures

A self-administered pen and paper questionnaire was used to collect baseline data (April 2006 to February 2008) and post intervention data (May 2008 and October 2008). The survey items were developed based on established and previously used measures of alcohol

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3 consumption [21-23] and pilot tested with players from a GAA club outside the study
4 counties. Research personnel distributed surveys to players after one or two training sessions
5 at each club. A questionnaire was also administered to the GAA manager on duty at the club
6 on the night of the player survey to collect information on club characteristics and
7 intervention fidelity.
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10 11 12 13 *Primary outcome measures - alcohol consumption*

14 Primary study outcomes were the proportions of players consuming: more than 21 units of
15 alcohol per week; and 6+ standard drinks on a single occasion at least once per week. A
16 modified version of the Quantity-Frequency Scale (QF-Scale) [21] was used to measure
17 alcohol consumption in litres of pure alcohol. Further information is provided in Box S1.
18 Grams of pure alcohol consumed were calculated assuming 4.5%, 12.5% and 33%
19 alcohol/volume for beer, wine and spirits, respectively. A standard drink was defined as 12
20 grams of alcohol.
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27 28 *Secondary outcomes measures – alcohol-related harm*

29 Alcohol Use Disorders Identification Test (AUDIT) total and sub-scale scores [23] and
30 number of alcohol-related harms were secondary outcomes. Mean total AUDIT score for
31 players was reported and the proportion of players with total AUDIT scores of 8 and above
32 was used to categorise members as consuming alcohol at risky/high-risk levels [23]. For the
33 AUDIT subscales, increased risk of alcohol-related harm was defined as: a hazardous use
34 score of 6 or more (items 1–3); a dependency score of 4 or more (items 4–6); a harmful use
35 score of 1 or more (items 7–10) [23]. Players were asked 13 questions about their experiences
36 of alcohol-related harm derived from a national study of the habits of Irish drinkers (see Box
37 S2) [22]. The total number of harms experienced by each player was calculated and median
38 and mean numbers of harms for control and intervention group club players reported.
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48 *Player and club characteristics*

49 Players were asked their age, highest level of education, sports played at the club (hurling
50 and/or Gaelic football) and age at first full alcoholic drink. Club managers were asked the
51 number of players at the club. Clubs were classified as rural (total population of less than
52 1,500) or urban based on geographic location.
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58 *Intervention fidelity and exposure*

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3 Project records were used to collect data on implementation of the intervention components
4 and on the number of players, managers and coaches that attended intervention sessions. Club
5 managers reported on the development and implementation of a club alcohol policy.
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9 10 **Sample size and power calculations**

11 Sample size was based on detecting a 10% reduction in the prevalence of the consumption of
12 6 or more drinks on a single occasion once a week for the repeat cross-sectional samples. The
13 baseline prevalence of this outcome was estimated to be 48% [22]. With power of 80% and a
14 two-sided significance level of 5%, 760 participants (380 in control and 380 in intervention
15 group) were estimated to be required at post-intervention. To account for clustering by club,
16 the estimate was inflated by an intra-cluster correlation of 0.01 [24], resulting in a required
17 sample of 942 players at post-intervention (38 clusters; average of 25 players per cluster).
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24 25 **Statistical analysis**

26 The primary analysis of all trial outcomes was undertaken using data from the repeat cross-
27 sectional samples of players at pre-intervention and post-intervention for those clubs that had
28 both pre- and post-intervention data ('complete' data). For all outcomes, secondary analysis
29 was undertaken on paired data available for players who completed both pre-intervention and
30 post-intervention surveys.
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36 For all outcome measures, generalized linear mixed models were developed utilizing logistic
37 regression analyses for categorical outcomes, linear regression for continuous outcomes, and
38 negative binomial regression for count outcomes. Time and group variables were included in
39 each model and adjustments made for clustering at the club level through a random club-
40 specific intercept term. Each model controlled for age, level of education and age of onset of
41 alcohol consumption (first full alcoholic drink) as baseline data showed these variables to be
42 associated with alcohol use outcomes. A significance threshold of 0.05 was used for analysis
43 of primary outcomes and 0.01 for secondary outcomes. Such analysis was undertaken for the
44 repeat cross-sectional samples of players and paired participant data, with an additional
45 random subject-specific intercept to account for repeated measurements on the same subject
46 for the latter.
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56 For the cross-sectional samples, additional sensitivity analysis was undertaken for all
57 outcomes to assess the impact of missing data. Using multiple imputation, missing data were
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3 assigned using the chained equations method of generating a number of complete data sets
4 [25]. The imputation model included covariates considered to be associated with either the
5 missing data or the outcome itself (level of education and age of onset of alcohol
6 consumption) [25]. Regression coefficients and standard errors from all imputed data sets
7 were then pooled using the method reported by Rubin [26].
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12 All statistical analyses were conducted using SAS v9.4 (SAS Institute, Cary, North Carolina,
13 USA).
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16 17 18 **RESULTS**

19 **Participants**

20 *Repeat cross sectional samples*

21 Club and player participation in the trial is described in Figure 1. Of the 14 clubs from the
22 intervention county that were randomly selected and invited to participate in the trial, 12
23 consented to participate (85.7%). Of the 29 clubs within the control county, 27 (93.1%)
24 agreed to participate. Pre-intervention data were collected from 960 players (Control: n=628,
25 70.2% consent rate; Intervention: n=332, 77.2% consent rate). Two control clubs were lost to
26 follow-up for which data were imputed. Players from twenty-five control clubs (n=441) and
27 all 12 intervention clubs (n=218) participated in post-intervention data collection.
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35 *Paired data*

36 One-hundred and eighty two players from 23 control group clubs and 106 players from 12
37 intervention group clubs provided both pre- and post-intervention data.
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46 **Sample description**

47 Pre-intervention, control and intervention clubs were similar in size, but differed on
48 geographic region, with 84% of control clubs classified as rural compared to 58% of
49 intervention clubs. Most players from both control and intervention group clubs were football
50 players (95% and 89%, respectively) with 43% and 30%, respectively, playing both hurling
51 and football. The mean age of players was 24.0 years (SD: 5.2) and the mean age at first
52 alcoholic drink was 15.3 years (SD: 2.4). Both were similar across control and intervention
53 groups. See Table S2 for further information on clubs and players.
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Outcome analysis

Repeat cross-sectional samples

Summary statistics for each primary and secondary outcome for the repeat cross-sectional sample analysis are shown in Table 1 and the results of the generalized linear mixed models for these analyses are shown in Table 2. At pre-intervention, around half the players reported drinking more than 6 drinks on at least one occasion each week (50% control group; 54% intervention group) and at post-intervention these proportions were similar (47% control group; 49% intervention group). At pre-intervention, 30% of players in the control group and 31% in the intervention group reported consuming over the weekly recommendation of 21 units of alcohol per week. Post-intervention, these proportions were 24% for control group players and 22% for intervention group players.

The proportion of players that reported a total AUDIT score above 8 was similar across both groups pre-intervention (control: 76%; intervention: 73%) and post-intervention (control: 70%; intervention: 73%). Based on the AUDIT subscales, at pre-intervention, almost all players (control: 95%; intervention: 94%) were assessed as drinking at hazardous levels, three-quarters at levels that placed them in harmful situations (control: 75%; intervention: 72%) and 60% at risk of alcohol dependence (control: 60%; intervention: 61%). For all AUDIT-subscale measures, post-intervention proportions remained similar to pre-intervention proportions.

There were no significant between-group differences at follow-up for those players who had complete repeat cross-sectional data for any of the primary or secondary outcome variables. Results from the sensitivity analysis of the imputed data sets similarly showed no significant between-group differences for most outcomes, apart from number of alcohol-related harms (Table 2). This analysis found a statistically significant lower median number of alcohol-related harms amongst intervention group players (median: 1; range 0-13) compared to control group players (median: 2; range 0-13) at post-intervention (IRR 0.78 (0.63, 0.98); P=0.029) (Table 2).

<Insert Table 1 about here>

<Insert Table 2 about here>

Paired data

There were 287 individual players with data available at pre- and post-intervention. Summary statistics for these players are reported in Table 3 and results of the generalized linear mixed models in Table 4. There were no statistically significant differences in AUDIT scores or consumption of 6 drinks on at least one occasion each week or >21 units of alcohol per week, although both were lower in the intervention group at follow-up.

There was a statistically significant reduction in the number of alcohol related harms reported by players in the intervention group at post-intervention compared to players in the control group (IRR = 0.56, p=0.0054) (Table 4).

<Insert Table 3 about here>

<Insert Table 4 about here>

Intervention fidelity and exposure

Player and manager/coach participation in the various components of the intervention was low. Just over half of the players (n=115, 52.7%) from intervention group clubs that were surveyed post intervention reported that they attended the alcohol training session and 14.2% (n=31) reported being aware of the awareness campaign.

Two-thirds (n=8) of the 12 intervention club managers attended the alcohol training session and half (n=6) attended the alcohol policy session. None of the clubs had a written alcohol policy prior to the intervention and one third (n=4) had one in place after the intervention. All 12 of the managers were aware of the intervention being conducted at their club. Thirteen coaches from a quarter of the clubs (n=3) attended the alcohol education session for coaches.

DISCUSSION

This is only the second study globally to report the outcomes of an alcohol-harm reduction intervention in community sports clubs. Post-intervention there was no significant difference between intervention and control group club players in the proportion consuming 6 or more drinks on at least one occasion per week, drinking more than the weekly recommended limit of 21 units of alcohol per week, or with total AUDIT or AUDIT subscales scores indicative of risk of alcohol-related harm. There was, however, for players with both pre- and post-

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3 intervention (paired) data, a statistically significant difference, post-intervention, in the
4 median number of alcohol-related harms amongst players of intervention clubs compared to
5 players of control group clubs (IRR 0.56 (0.37, 0.84); P=0.005).
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10 The findings of this trial differ, in part, from those of the trial conducted by Kingsland et al
11 (2015) with community football clubs in Australia. Compared to the findings of this trial, the
12 intervention reported by Kingsland et al 2015 was found to be effective in reducing risky
13 alcohol consumption by community football club members at the club as well as risk of
14 alcohol-related harm overall [19]. The contrasting results may be the result of a number of
15 differences between the studies. First, the participants differed across the two trials. All
16 participants in the current trial were players, whereas the participants in the Kingsland et al
17 (2015) trial were a mixture of players (53%), fans/supporters (16%) and club
18 management/coaches/other (30%). While the Kingsland et al (2015) trial did not report
19 effectiveness for these participant groups individually, there is the potential that alcohol
20 management interventions implemented at the club bar may have been more effective for
21 groups other than players [27].
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31 Second, the implementation of the intervention in the Kingsland et al (2015) trial was
32 supported by a suite of practice change support strategies that were not included in the
33 current study, such as, observational audit and feedback, accreditation, cost-recovery, and
34 support from sporting associations [28]. Implementation science theory asserts that such
35 strategies are important for interventions to be effectively implemented and achieve
36 maximum participant uptake [29].
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43 Third, the intervention in the trial conducted by Kingsland et al (2015) was implemented over
44 2.5 years compared to the 4-month period in this study. The longer period of the Kingsland et
45 al (2015) intervention may have resulted in greater club member exposure to the intervention
46 and hence greater impact on levels of alcohol consumption and related harms. Both time and
47 dose have been found to be associated with intervention effectiveness and may account for
48 some of the differential effect between the two studies [30].
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55 Low levels of intervention participation and acceptability may have also contributed to the
56 ineffectiveness of the intervention. Only 52.7% of the players in the intervention group
57 attended the alcohol training session, and only 14.2% reported knowledge of the awareness
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3 campaign. Attendance at the coach training session was also low with, only 13 coaches (from
4 three clubs) attending the training session. As the coaches found the alcohol training session
5 useful, higher uptake among the clubs may have had more impact on alcohol outcome
6 measures. Furthermore, although a majority of the managers (83.3%) reported that they found
7 the intervention useful, only 4 of the 12 clubs had implemented a written alcohol policy at the
8 end of the intervention, an important environmental strategy to support the other education-
9 based intervention strategies. Future alcohol harm reduction trials in the sports setting should
10 seek to increase the implementation of socio-environmental strategies, which theory and
11 evidence suggest are important in modifying alcohol use behaviour [17]. Such trials should
12 also test the effectiveness of individual strategies so that interventions can continue to be
13 refined for maximum effectiveness and efficiency.
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23 Despite these factors, the positive intervention effect for the alcohol-related harm outcome
24 suggests the intervention was of sufficient intensity and duration to impact on this measure.
25 Possible explanations for the differential findings by outcome measure may be greater
26 statistical power obtained from a repeated measures analytical approach for the paired count
27 data or greater appeal of the intervention content focussing on the avoidance of harms rather
28 than on alcohol consumption per se. This finding, together with unpublished evidence of
29 GAA clubs independently implementing harm reduction measures and limiting alcohol-
30 industry sponsorship, suggests that re-designed alcohol-harm reduction program trials are
31 warranted and feasible.
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40 While the controlled study design and the randomisation of intervention county clubs were
41 strengths of the study, a number of limitations need to be noted. Counties were not randomly
42 assigned to control and intervention groups and this may have resulted in the outcomes being
43 confounded by factors that were not controlled for in the analysis. The study only included
44 male players and, as such, the findings cannot be generalised to female players, and the study
45 was not powered to assess any differential intervention effects by level of player
46 professionalism or rural/urban location. Differences in the length of pre-intervention (May
47 2006-April 2008) and post-intervention (May-Oct 2008) data collection periods should also
48 be noted. While it is unknown how these differences may have affected the trial outcomes,
49 periods of similar length and seasonality might have elicited a different result. Finally, the
50 study may have been underpowered to detect effects of the intervention given that the final
51 participant numbers were substantially lower than the predicted required sample size.
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Given the limited number of controlled trials of interventions to reduce alcohol misuse and alcohol related harm in the sports setting, and the different findings of the two that have been conducted, further high quality trials are required to determine if such interventions are feasible and effective. These trials should include: greater focus on strategies to support implementation, such as those employed by Kingsland et al (2015), a longer implementation period and strategies focused on modifying the drinking environment as well as providing training to players and clubs.

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TABLES

Table 1: Summary of outcome variables for cross-sectional samples, pre- and post-intervention

| Variable | | Pre-intervention | | Post-intervention | |
|---|-------------------|---------------------------------|-------------------------|--------------------|-------------------------|
| | | Control ^a (n=591) | Intervention (n=332) | Control (n=441) | Intervention (n=218) |
| | | n (%) | n (%) | n (%) | n (%) |
| Regularly >21 units alc./week | No | 393 (70%) | 219 (69%) | 258 (76%) | 112 (78%) |
| | Yes | 170 (30%) | 100 (31%) | 83 (24%) | 32 (22%) |
| Regular heavy episodic drinking | No | 280 (50%) | 150 (46%) | 192 (53%) | 109 (51%) |
| | Yes | 285 (50%) | 174 (54%) | 168 (47%) | 103 (49%) |
| Total AUDIT ^b score (from possible 40) | Mean (SD) | 12 (6) | 12 (6) | 11 (6) | 11 (6) |
| | Median (range) | 11 (0, 34) | 11 (0, 33) | 10 (0, 31) | 10 (0, 36) |
| Total AUDIT ^b score 8+ | <8 | 123 (24%) | 81 (27%) | 104 (30%) | 50 (27%) |
| | 8 or more | 390 (76%) | 217 (73%) | 246 (70%) | 135 (73%) |
| AUDIT ^b hazardous subscale score 6+ | < 6 | 30 (5.3%) | 19 (5.9%) | 21 (5.1%) | 10 (4.8%) |
| | 6 or more | 532 (95%) | 304 (94%) | 388 (95%) | 197 (95%) |
| AUDIT ^b dependency subscale score 4+ | <4 | 225 (40%) | 125 (39%) | 162 (40%) | 83 (40%) |
| | 4 or more | 336 (60%) | 197 (61%) | 242 (60%) | 124 (60%) |
| AUDIT ^b harmful subscale score 1+ | <1 | 139 (25%) | 89 (28%) | 124 (31%) | 52 (25%) |
| | 1 or more | 426 (75%) | 234 (72%) | 277 (69%) | 155 (75%) |
| Number of alcohol-related harms | Mean (SD) | 4 (3) | 4 (3) | 3 (3) | 3 (3) |
| | Median (range) | 4 (0, 13) | 3 (0, 13) | 2 (0, 13) | 1 (0, 13) |

^a For control clubs followed up post-intervention. ^b Alcohol Use Disorders Identification Test

Table 2: Intervention effects for cross-sectional samples at follow-up (adjusted^a)

| Outcome | ICC | Clubs with complete data | | | Sensitivity analysis (imputed data) | |
|--|------|-----------------------------------|---------|---|--|---------|
| | | OR ^b (95% CI) | P-value | Interaction OR ^c (95% CI) | OR ^b (95% CI) | P-value |
| Regularly >21 units alc./week | 0.02 | 0.81 (0.48, 1.36) | 0.422 | 0.79 (0.44, 1.40) | 0.96 (0.57, 1.60) | 0.867 |
| Regular heavy episodic drinking | 0.05 | 1.07 (0.64, 1.79) | 0.784 | 0.99 (0.60, 1.65) | 1.09 (0.69, 1.73) | 0.709 |
| Total AUDIT ^d score (from possible 40) <i>(Difference in means, intervention -control)</i> | 0.01 | 0.09 (-1.19, 1.37) | 0.891 | 0.47 (-1.02, 1.95) | 0.03 (-1.13, 1.20) | 0.956 |
| Total AUDIT ^d score 8+ | 0.02 | 1.03 (0.62, 1.70) | 0.910 | 1.29 (0.72, 2.29) | 1.11 (0.75, 1.64) | 0.611 |
| AUDIT ^d hazardous subscale score 6+ | 0.03 | 1.26 (0.40, 3.95) | 0.696 | 1.77 (0.49, 6.32) | 0.89 (0.37, 2.12) | 0.791 |
| AUDIT ^d dependency subscale score 4+ | 0.01 | 0.86 (0.56, 1.32) | 0.501 | 0.86 (0.52, 1.41) | 0.97 (0.67, 1.42) | 0.885 |
| AUDIT ^d harmful subscale score 1+ | 0.01 | 1.28 (0.79, 2.07) | 0.309 | 1.62 (0.92, 2.83) | 1.26 (0.84, 1.89) | 0.267 |
| Number alcohol related harms | 0.01 | IRR ^e 1.14 (0.93,1.39) | 0.205 | IRR ^e 1.25 (0.99, 1.57) | IRR ^e 0.78 (0.63, 0.98) | 0.029 |

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^a Adjusted for age, age of onset of alcohol use and Leaving Certificate. ^b Odds Ratio: intervention v control post-intervention. ^c Odds Ratio: difference in how the outcomes changed over time. ICC = intra-class correlation. ^d Alcohol Use Disorders Identification Test. ^e Incident Rate Ratio.

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Table 3: Summary of outcome variables for paired data pre- and post-intervention

| Variable | | Pre-intervention | | Post-intervention | |
|---|--------------|--------------------|-------------------------|--------------------|-------------------------|
| | | Control (n=182) | Intervention (n=106) | Control (n=182) | Intervention (n=106) |
| Regularly >21 units alc./week | No | 116 (67%) | 76 (74%) | 110 (71%) | 56 (79%) |
| | Yes | 56 (33%) | 27 (26%) | 45 (29%) | 15 (21%) |
| Regular heavy episodic drinking | No | 91 (52%) | 50 (49%) | 80 (49%) | 57 (55%) |
| | Yes | 84 (48%) | 52 (51%) | 83 (51%) | 47 (45%) |
| Total AUDIT ^a score (from possible 40) | Mean | 12 (6) | 12 (7) | 11 (6) | 11 (5) |
| | Median | 11 (0, 34) | 11 (0, 33) | 11 (0, 31) | 10 (0, 29) |
| Total AUDIT ^a score 8+ | <8 | 36 (22%) | 30 (31%) | 47 (30%) | 26 (29%) |
| | 8 or more | 127 (78%) | 66 (69%) | 111 (70%) | 65 (71%) |
| AUDIT ^a hazardous subscale score 6+ | < 6 | 6 (3.5%) | 8 (7.7%) | 3 (1.8%) | 7 (6.9%) |
| | 6 or more | 166 (97%) | 96 (92%) | 167 (98%) | 95 (93%) |
| AUDIT ^a dependency subscale score 4+ | <4 | 63 (37%) | 48 (46%) | 61 (36%) | 44 (43%) |
| | 4 or more | 109 (63%) | 56 (54%) | 108 (64%) | 58 (57%) |
| AUDIT ^a harmful subscale score 1+ | <1 | 41 (24%) | 34 (33%) | 44 (26%) | 34 (33%) |
| | 1 or more | 132 (76%) | 70 (67%) | 125 (74%) | 68 (67%) |
| Number of reported alcohol- related harms | Mean | 4 (3) | 3 (3) | 3 (3) | 2 (3) |
| | Median | 4 (0, 13) | 3 (0, 13) | 3 (0, 13) | 0 (0, 11) |

^a Alcohol Use Disorders Identification Test.

Table 4: Intervention effects for paired data at follow-up

| Variable | Interaction OR ^a | | P-value |
|--|---------------------------------------|---------------------------------------|---------|
| | (95%CI) | OR ^b (95% CI) | |
| Regularly >21 units alc./week | 0.92 (0.34, 2.45) | 0.62 (0.27, 1.41) | 0.250 |
| Regularly heavy episodic drink | 0.64 (0.28, 1.49) | 0.75 (0.35, 1.59) | 0.447 |
| Total AUDIT ^c score (Difference in means, intervention-control) | -0.06 (-1.46, 1.34) | -0.55 (-2.04, 0.93) | 0.454 |
| AUDIT ^c score > 8 | 3.24 (0.93, 11.27) | 1.18 (0.31, 4.46) | 0.802 |
| AUDIT ^c score hazardous score 6+ | 0.54 (0.00, 693.40) | 0.25 (0.00, 236.10) | 0.688 |
| AUDIT ^c score dependency score 4+ | 1.11 (0.47, 2.64) | 0.61 (0.27, 1.40) | 0.244 |
| AUDIT ^c score harmful score 1+ | 1.17 (0.41, 3.39) | 0.50 (0.16, 1.52) | 0.220 |
| Number of alcohol-related harms | IRR ^d 0.70 (0.51, 0.94) | IRR ^d 0.56 (0.37, 0.84) | 0.005 |

^aOdds Ratio: intervention v control post-intervention. ^c Odds Ratio: difference in how the outcomes changed over time. ^bOdds ratio: intervention v control post-intervention.

^cAlcohol Use Disorders Identification Test. ^dIncident Rate Ratio.

Table S1: Intervention content and format

| Intervention component | Content | Format |
|--|--|---|
| 1. Alcohol education for players | <ul style="list-style-type: none"> • Alcohol use recommendations • Harmful drinking • Drinking and sport • Harm reduction | <ul style="list-style-type: none"> • 1 x 10 minute introduction presentation • 1 x 60 minute alcohol education presentation + discussion (10 min introduction + 40 min presentation and 10 min question and answer session) |
| 2. Alcohol education for coaches/managers | <ul style="list-style-type: none"> • Identifying alcohol-related problems • Tackling alcohol-related problems among players, including addressing alcohol use culture within club • Responsible service of alcohol at club bars | <ul style="list-style-type: none"> • 1 x 40 minute presentation + discussion and 20 min question and answer session • Hand-outs |
| 3. Alcohol policy workshop for club managers | <ul style="list-style-type: none"> • Developing a written alcohol management policy for a GAA club • Current liquor licensing laws | <ul style="list-style-type: none"> • 1 x 10 minute presentation • 1 x 40 minute workshop or writing an alcohol policy |
| 4. Awareness campaign: "Less Pints, More Points" | <ul style="list-style-type: none"> • Impact of alcohol use on health and sports performance • Details of intervention | <ul style="list-style-type: none"> • Advertisements/posters in club dressing rooms and bars, on match programmes and club websites |

Box S1: Measurement of primary outcomes

To measure frequency of consumption for each of four beverage types (beer/cider/wine/spirits), participants were asked: "During the past 12 months how often did you usually drink beer/cider/wine/spirits?". The response options were: "Every day", "4-5 times per week", "2-3 times per week", "Once a week", "2-3 times per month", "Once a month", "Less often than once a month", "Never". To measure quantity of consumption, participants were asked, for each beverage type: "When you drink beer/cider/wine/spirits, how much do you usually drink?" The responses for beers/ciders were "Half pints", "Pints", "Small cans" and "Large cans"; for wine were "Glasses", "Quarter bottles" and "Bottles"; and for spirits were "Single measure of spirit", "Single shot" and "Bottle of pre-mixed spirits".

The proportion of players who reported drinking six or more standard alcoholic drinks in one sitting at least once a week was determined by asking: "During the last month, how many times have you had six or more standard drinks in a row?" A standard drink was defined as one glass beer/lager/cider, a glass of wine, a measure of spirits. A pint of beer/ lager or stout was defined as two drinks. The response options were: "Never", "Once a month", "Twice a month", "3-5 times per month", "6 to nine times per month" or "10 or more times per month".

Table S2: Comparison of club and player characteristics at baseline

| Characteristic | | Control ^a | Intervention | Total |
|---------------------------------|-------------------|----------------------|-------------------|-------------------|
| Clubs | | n=25 | n=12 | N=39 |
| Large club (>40 Players) | No | 19 (76%) | 8 (67%) | 27 (73%) |
| | Yes | 6 (24%) | 4 (33%) | 10 (27%) |
| Number of registered players | Mean (SD) | 34 (11) | 36 (11) | 34 (11) |
| | Median (min, max) | 30 (25, 60) | 31 (25, 60) | 30 (25, 60) |
| Geographic region | Rural | 21 (84%) | 7 (58%) | 28 (76%) |
| | Urban | 4 (16%) | 5 (42%) | 9 (24%) |
| Players | | n=591 | n=332 | N=923 |
| Attained Leaving Certificate | No | 150 (26%) | 62 (19%) | 212 (23%) |
| | Yes | 429 (74%) | 268 (81%) | 697 (77%) |
| Hurling player | No | 390 (66%) | 154 (46%) | 544 (59%) |
| | Yes | 201 (34%) | 178 (54%) | 379 (41%) |
| Football player | No | 30 (5.1%) | 37 (11%) | 67 (7.3%) |
| | Yes | 561 (95%) | 295 (89%) | 856 (93%) |
| Hurling and football player | No | 414 (70%) | 190 (57%) | 604 (65%) |
| | Yes | 177 (30%) | 142 (43%) | 319 (35%) |
| Age of player | Mean (SD) | 23.8 (5.2) | 24.3 (5.2) | 24.0 (5.2) |
| | Median (min, max) | 22.8 (16.0, 46.5) | 23.9 (16.0, 41.4) | 23.0 (16.0, 46.5) |
| Age at first alcoholic drink | Mean (SD) | 15.4 (2.5) | 15.1 (2.1) | 15.3 (2.4) |
| | Median (min, max) | 15.5 (5.0, 42.0) | 15.0 (5.0, 30.0) | 15.0 (5.0, 42.0) |

^a Baseline characteristics for the 25 control clubs that provided data at post-intervention.