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Effects of a workplace prevention program for problem gambling: A cluster-randomized controlled trial

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Abstract: Background and Aims: This study evaluated whether a preventive intervention program for problem gambling would increase managers' inclination to act when concerned about gambling in the workplace. **Design:** Cluster-randomized controlled trial. Ten workplaces were randomized to either intervention or control condition. **Participants:** At the 12-month endpoint, there were $n = 136$ managers and $n = 1594$ subordinates in the intervention group, and $n = 137$ managers and $n = 1150$ subordinates in the waitlist group. **Intervention:** The intervention consisted of (1) six hours of skill-development training for managers regarding gambling, problem gambling, gaming, and harmful use of psychoactive drugs, and (2) six to eight hours of assistance in developing or improving workplace gambling policy. **Measurements:** The primary outcome was the managers' self-rated (on a 1 to 10 scale) inclination to act when concerned about an employee's problem gambling 12 months after baseline. **Findings:** The between-group difference in the managers' inclination for the full intervention group ($M = 8$) and the control group ($M = 7.4$) was not significant at the 12-month follow-up, but it was when only including managers who attended the skill-development training ($M = 8.2$), $d = 0.31$, $p = .04$. **Conclusion:** A workplace prevention program aimed to increase managers' inclination to act when they are concerned regarding an employee's gambling resulted in statistically significant changes for those who attended training, but not for the whole intervention group when non-attendees were included.

Keywords: Gambling, Problem Gambling, Prevention, Workplace, Cluster Randomized Trial.

Introduction

Problem Gambling (PG) is characterized by gambling-related behaviours that are associated with negative consequences for the individual gambler and their surroundings (Neal et al., 2005). In Sweden, the point prevalence of PG is around 2% (Abbott et al., 2014), and thus considered a public health concern. Although there are various treatments for PG (Magnusson et al., 2019; Nilsson et al., 2019), published studies on workplace health promotion programs (WHPPs) for it are few, despite recommendations to develop such programs dating back more than a decade (Griffiths, 2009; Hawley et al., 2007).

In one study, over 70% of callers to a problem gambling helpline were employed at the time of the call (Hawley et al., 2007). Another study found a fourteen-fold higher odds of PG when gambling during working hours (Revheim & Buvik, 2008). A number of workplace-related harms have been associated with PG, such as increased absenteeism, poor performance, fraud and theft, which could result in job loss and diminished future employment opportunities for the problem gambler (Langham et al., 2016). Exacerbating this situation is that when criminal activities occur related to PG such as thefts, managers have often failed to discover them in a timely manner (Kelly & Hartley, 2010).

Another more recent call for PG prevention in the workplace presented measures to prevent and respond to gambling-related harm and crime in the workplace (Binde, 2016). In addition to policy implementation, it was also noted that “problem gambling awareness, attention to signs of gambling-related harm, control functions, appropriate responses to harmful gambling, and rehabilitation” should be included when addressing the problem of PG in the workplace (Binde, 2016, p. 247). Problem gamblers may thereby benefit from managers and colleagues intervening at an early stage. While the scope of this study concerns PG, some researchers have discussed the potential benefits of *non*-problem gambling (e.g., sport-related office pools) in the workplace, such as management-employee communication and involvement and enhanced office cohesion (Smith-Ditizio et al., 2020).

With regard to substance abuse, it is common for workplaces to have policies and employee assistance programs in place to address this issue among workers. For alcohol, one study found that a WHPP for harm reduction successfully increased subordinates’ awareness of alcohol policies (Pidd et al., 2018). Furthermore, having such workplace policies has been associated with a lower alcohol and drug use, both at and away from the workplace (Pidd et al., 2016). In view of PG being considered a public health problem, implementing similar practices in the workplace for gambling would be feasible (Kolandai-Matchett et al., 2018). Published studies regarding policies for curbing problem gambling mainly concern university policies targeting students (e.g. Shaffer et al., 2005; Zhao et al., 2017), but it is also crucial that these be implemented in workplaces so that managers can more readily notice PG behaviours and act accordingly (Paul

& Townsend, 1998). Even if they do notice it, it has been argued that the bystander effect (the tendency for individuals to be less likely to help when other people are present) may be applicable to managers (Fischer et al., 2011; Rowe et al., 2009), as they may hesitate to act even when seeing unacceptable behaviour (Rowe et al., 2009). Therefore, workplace interventions for PG must include both training managers to identify PG, as well as efforts to encourage intervening actions when they do.

The aim of the current study was to evaluate the effects of a WHPP for PG by cluster-randomizing 10 organizations in Sweden to either an intervention group, or a wait-list group that served as a control. Specifically, this study evaluated the effect of the intervention by comparing the intervention group with the waitlist group at six and 12 months after the baseline measurement. As noted in the study protocol (Rafi et al., 2017), the intervention was hypothesized to (1) make managers more inclined to engage in conversations with subordinates whose PG or other harmful behaviours have raised managers' concerns, (2) increase managers' and subordinates' knowledge of whom in the workplace they may contact when concerned about PG, (3) decrease managers' and subordinates' concerns about a colleague's potential PG, (4) increase managers' and subordinates' actions to help an employee or a colleague with PG, (5) increase managers' knowledge of how to act when concerned about an employee with PG, (6) decrease sum scores of the Problem Gambling Severity Index (PGSI; Ferris & Wynne, 2001) among managers and subordinates, and (7) lower the likelihood for managers and subordinates to be categorized as PG by the PGSI. Although not pre-registered, a final additional hypothesis was (8) that the intervention would lead to more managers and subordinates being aware of an existing PG policy.

METHODS

Design

The study was a cluster-randomized controlled trial with two arms: (1) the intervention program and (2) an assessment only control, which was wait-listed and offered the same prevention program one year later. Cluster-randomizing the organizations reflects the way in which the intervention is usually given and reduces the risk of contamination, since individuals within organizations are more likely to interact and affect each other than individuals in separate organizations. The recruitment was performed by Alna, a Swedish organization that also developed and delivered the intervention. Alna is an organization that provides other organizations with services regarding both harmful use of psychoactive drugs, and harmful behaviours such as problem gambling and gaming. In this study, the term other harmful use (OHU) will be used to refer to other types of harmful use other than gambling (e.g., alcohol, drugs, gaming).

The study design, including recruitment, randomization, and intervention details, was pre-registered (NCT02925286), and described in detail in the study protocol (Rafi et al., 2017). Briefly, a baseline survey was

conducted after randomization, followed by the intervention and follow-up measurements at six months post-baseline for managers and 12 months post-baseline for both managers and subordinates. In contrast to the intended design described in the study protocol, there was no follow-up 24 months post-baseline due to external factors relating to funding.

Participants

The recruitment of organizations was performed by Alna. First, information was sent to all organizations included in their registry of potential customers with a minimum of 100 subordinates ($n = 1967$ organizations). Second, representatives of each organization were presented with information about the study during a conference on gambling and PG in October 2015, which consisted of a short overview and a rationale for the intervention. While none of the organizations represented at the conference expressed interest in participating in the study, 12 organizations from Alna's registry responded with interest in participating—though two of these dropped out before randomization, leaving ten organizations to be randomized. These are described in detail in the study protocol (Rafi et al., 2017).

For each organization, all currently employed managers and subordinates at each measurement occasion were considered eligible to participate in the study. The rationale for including participants after the intervention was that the intervention targeted the organizational level and aimed to affect the organization in a way that would benefit any newly employed individuals as well. There were no exclusion criteria. This study was given ethical approval by the regional ethics board of Stockholm, Sweden (registration 2016/1208-31/5).

Intervention

The intervention used was a PG prevention program (PGPP) developed jointly by Alna and participating organizations from a previous project to prevent or minimize organizational and individual harms from PG. The PGPP included two components: (1) implementation/improvement of workplace gambling policy, and (2) skill-development training for managers.

The first component of policy implementation consisted of helping organizations strengthen or develop and implement workplace policies for gambling at work. The development and/or improvement of the policy was carried out on three to four occasions (depending on organizational availability), together with the organization's HR-officers, each lasting approximately two hours. The second component was a skill-development initiative in which managers were provided two 3.5-hour face-to-face group training sessions regarding addiction in general and gambling in particular. Due to the variations in organizational and managerial availability, the time between the two sessions varied. Two organizations had two weeks between sessions, one organization had three weeks, and two organizations had nine weeks. The main topics of the skill development training is described in

Supporting Information, Table S2, and a full description of the intervention is available in the study protocol (Rafi et al., 2017). The intervention was delivered to the organizations between one and three months after baseline, depending on the availability of the organization.

An online survey was distributed to participants on three occasions: at baseline, six months after baseline, and 12 months after baseline. After the six-month follow-up, qualitative interviews were conducted, with details and results published elsewhere (Rafi et al., 2019). Questionnaires were administered online using Iterapi, a secure and encrypted data collection platform (Carlbring et al., 2007; Vlaescu et al., 2016). Email reminders were sent maximum four times for each occasion, with five to seven days between each reminder. In three organizations, a total of $n = 1040$ participants had no email address and either used a shared workplace computer to complete the questionnaire or received a paper version, using the procedure described in the study protocol. Organizations in the waitlist group were given the same measures as the intervention group but did not receive the PGPP until after the 12-month follow-up.

Outcomes

The primary outcome measure, related to hypothesis 1, was the managers' inclination to engage in a conversation with subordinates whom they suspected had a gambling problem or OHU, rated on a scale from 1 (not inclined) to 10 (very inclined), twelve months after baseline. This was also measured six months after baseline as a secondary outcome, along with the following secondary outcomes, measured at both six and twelve months after baseline:

- (2) Whether one had acted to support an employee during the past six/twelve months.
- (3) Worrying about a co-worker or manager due to possible harmful use during the past six/twelve months.
- (4) Managers perceived confidence regarding how to act when suspecting harmful use in the workplace, rated from 1 (very diffident) to 10 (very confident).
- (5) Sum scores on the PGSI.
- (6) Proportion of PGSI categories.
- (7) Knowing who to contact at work if concerned (subordinates only).
- (8) Knowing that a gambling policy exists.

All outcome measures except gambling policy were pre-registered. Gambling policy was included as a secondary outcome measure because none of the others spoke to the policy component of the intervention. Commonly used to estimate the prevalence of PG in a population, the PGSI consists of nine items, each allowing a score from 0 to 3. The total score of the nine items, ranging from 0 to 27, can be used to categorize an individual as having PG based on cut-off scores (0 = no PG, 1–2 = low levels of PG,

3–7 = moderate levels of PG, 8 or more = PG). In the original article (Ferris & Wynne, 2001), the PGSI had a Cronbach's alpha of .84, indicating good internal consistency. In addition to the PGSI, several more items were developed specifically for this project and included in the questionnaire (Supporting Information, Table S3, includes an English translation of these items). These were subjected to exploratory analyses due to the items not having been pre-registered. Briefly, these questions included: (1) whether a written policy existed for alcohol, illegal drugs, games, and/or medicines, (2) whether they knew who to refer to if a colleague exhibited harmful use in areas other than gambling, (3) whether the respondent had concerns about a colleague in areas of harmful use other than gambling, (4) whether the respondent knew someone in the workplace who was gambling or gaming during work hours, (5) the respondents' own gambling habits, and (6) managers' ratings of their own knowledge regarding gambling and PG in the workplace. Because the questionnaire was sent only to the currently employed individuals, the no longer employed did not receive any follow-up questionnaire.

Statistical Methods

Statistical analyses were conducted within a linear mixed-model framework, which allowed modeling of hierarchically clustered data (Hesser, 2015). Because we had no data regarding the clustering of subordinates to managers, subordinates were clustered to their respective organization when modeling the subordinates' intervention effect. Data preparation and graphics were performed using the collection of R (R Core Team, 2021) packages in the tidyverse software (Wickham et al., 2019). Statistical analyses were performed using R packages lme4 (Bates et al., 2015) for continuous outcomes and GLMMadaptive (Rizopoulos, 2020) for categorical outcomes with a binomial distribution, using the adaptive Gauss-Hermite quadrature rule to increase accuracy (Pinheiro & Chao, 2006).

All models included age and gender as covariates. Individuals who participated in the study by providing consent at least at one time point were included in the analyses, using maximum likelihood to estimate missing data from paper questionnaires. Because not all individuals who were randomized consented participation, it was impossible to perform an intent-to-treat analysis, as was originally stated in the study protocol. To test the robustness of the results, a sensitivity analysis was performed by analyzing only the managers in the intervention group who participated in the skill-development training (see Supporting Information, Table S4). Another reason to model the results both with and without all participants was that different models may be of interest to different readers depending on whether the primary interest is how the intervention affects whole organizations or how the intervention affects those participating. An effect size of Cohen's $d = 0.30$ was detectable given 80% power (Rafi et al., 2017).

RESULTS

Table 1 shows the demographic characteristics of managers and subordinates both at baseline and at the 12-month follow-up. Supporting Information, Figure S1 shows a flow diagram of the randomized organizations. All organizations that were randomized completed the trial. There were $n = 672$ managers and $n = 9580$ subordinates who were employed on at least one measurement occasion and thus eligible to participate. Of these, $n = 490$ (73%) managers and $n = 4146$ (43.3%) subordinates participated in the study by providing informed consent and responding to the survey at least once. At the 12-month follow-up, $n = 136$ managers and $n = 1594$ subordinates in the intervention group and $n = 137$ managers and $n = 1150$ subordinates in the waitlist group participated. Supporting Information, Table S5, shows response rates of managers and subordinates eligible to participate split by occasion and group. Supporting Information, Table S6, shows managers response rates split by occasion, group and whether one responded at baseline. Across all time points, 54% (131/242) of managers in the intervention group stated that they had participated in the skill-development training.

Table 1

Characteristics of Participating Managers and Subordinates by Experimental Group at Baseline and at Twelve Months Follow-up

	Managers				Subordinates ^a			
	Baseline		12-Month Follow-up		Baseline		12-Month Follow-up	
	Intervention ($n = 178$)	Control ($n = 193$)	Intervention ($n = 136$)	Control ($n = 137$)	Intervention ($n = 1817$)	Control ($n = 1577$)	Intervention ($n = 1594$)	Control ($n = 1150$)
Gender, n (%)								
Women	103 (57.9)	91 (47.4)	76 (55.9)	58 (43)	1049 (57.7)	1016 (64.4)	954 (59.8)	742 (64.5)
Age, n (%)								
< 24	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	31 (1.7)	17 (1.1)	39 (2.4)	16 (1.4)
25–34	7 (3.9)	3 (1.6)	5 (3.7)	1 (0.7)	236 (13)	223 (14.1)	228 (14.3)	176 (15.3)
35–44	53 (29.8)	47 (24.5)	42 (30.9)	30 (22.2)	466 (25.6)	456 (28.9)	396 (24.8)	318 (27.7)
45–54	64 (36)	81 (42.2)	55 (40.4)	63 (46.7)	592 (32.6)	468 (29.7)	502 (31.5)	358 (31.1)
55–64	51 (28.7)	59 (30.7)	32 (23.5)	39 (28.9)	450 (24.8)	398 (25.2)	399 (25)	275 (23.9)
>=65	3 (1.7)	2 (1)	2 (1.5)	2 (1.5)	42 (2.3)	15 (1)	30 (1.9)	7 (0.6)
Years of employment, n (%) ^b								
< 1 year	39 (21.9)	22 (11.5)	24 (17.6)	18 (13.3)	-	-	.	-
1–2 years	35 (19.7)	31 (16.1)	33 (24.3)	15 (11.1)	-	-	.	-
3–5 years	55 (30.9)	42 (21.9)	33 (24.3)	19 (14.1)	-	-	.	-
>5 years	49 (27.5)	97 (50.5)	46 (33.8)	83 (61.5)	-	-	.	-

^a Some item responses were missing from the paper questionnaires, leading to column sums being smaller than the actual n . ^b Item present only in managerial survey.

Table 2*Primary and Secondary Intervention Effects for Managers Split by Occasion*

	Observed values ^a		Coefficient	ES [95% CI] ^d	<i>p</i> -value
	Intervention ^b	Control ^c			
Primary outcome					
Inclination					
12 months	8 (1.7)	7.4 (2.3)	0.61	0.26 [0.05, 0.48]	.06
Secondary outcomes					
Inclination					
6 months	7.6 (1.9)	7.2 (2.4)	0.36	0.2 [-0.01, 0.42]	.19
Gambling policy exists ^e					
6 months	52.6%	15.2%	2.62	13.76 [3.82, 49.58]	< .001
12 months	61%	19.7%	2.69	14.68 [3.75, 57.38]	< .001
Who Gambling ^{e,f}					
6 months	84.8%	76.4%	0.18	1.2 [0.46, 3.12]	.71
12 months	95.6%	77.4%	1.94	6.96 [1.84, 26.37]	< .001
Acted ^e					
6 months	18.7%	14.6%	1.42	4.13 [1.41, 12.1]	.01
12 months	18.4%	13.9%	1.27	3.57 [1.12, 11.33]	.03
How to act PG					
6 months	6.2 (2.3)	5.2 (2.5)	1.29	0.54 [0.33, 0.76]	< .001
12 months	6.8 (2.1)	5.7 (2.7)	1.15	0.26 [0.04, 0.47]	< .001

^a Mean (SD) or %. ^b 6-month n = 171, 12-month n = 136. ^c 6-month n = 178, 12-month n = 137. ^d ES: Cohen's *d* or Odds Ratio, CI: Confidence Interval. ^e Reference level: yes. ^f Initially, there was a "don't know" response alternative. This response option was merged with the "no" option because it made no sense to separate the two.

Primary Outcome

The primary outcome (hypothesis 1) was the managers' inclination to engage in a conversation with subordinates whom they suspected had a problem with gambling or OHU. There was no statistically significant difference in inclination between the intervention and waitlist groups at 12 months (Table 2), $d = 0.26$, 95% CI [0.05, 0.48], $p = .06$. However, when only including those managers who attended skill-training, the difference did reach significance at the .05 level, $d = 0.31$, 95% CI [0.09, 0.52], $p = .04$.

Secondary Outcomes

Table 2 shows the intervention effects for the managers' secondary outcomes at six and 12-month follow-up. The managers' inclination to engage in a conversation was not significantly different at six-month follow-up, as with the 12-month follow-up. For the outcomes *Acted to help* (hypothesis 4), *How to act regarding PG* (hypothesis 5), and *Gambling policy exists* (hypothesis 8), significant intervention effects were found at

both six and 12 months. For the variable *Whom to consult regarding PG* (hypothesis 2), the intervention effect was significant at 12 months, but not at six months. The *PGSI sum scores* and *PGSI categories* (hypotheses 6 and 7) were excluded from the analyses due to their low incidence and variability ($M < 0.1$, $SD = 0.1-0.2$), resulting in unreliable models. Likewise, the variable *Worried* (hypothesis 3) was excluded due to unstable modeling solutions caused by the low frequency of managers who answered in the affirmative.

The sensitivity analysis (Supporting Information, Table S4) including only the managers who participated in the skill-development training yielded similar results, with two exceptions: besides the significant primary outcome mentioned above, the variable *Whom to consult regarding PG* was no longer significant. Supporting information, Table S7, shows exploratory analyses of manager secondary outcomes that were not pre-registered. The exploratory intervention outcomes that significantly favoured the intervention group at both follow-ups were (1) knowledge about gambling in the workplace, (2) knowledge about how to act when concerned about a colleague regarding gaming, and (3) knowledge of the gaming policy.

Table 3*Intervention Effects for Subordinates*

	Observed values ^a		Coefficient	ES [95% CI] ^b	<i>p</i> -value
	Intervention (<i>n</i> = 1594)	Control (<i>n</i> = 1150)			
Gambling policy exists ^c	30.6%	20.6%	0.64	1.89 [1.55, 2.31]	< .001
Who to refer to ^{c,d}	60.2%	60.3%	0.15	1.16 [1, 1.34]	.06
Worried ^c	2.1%	1.5%	-0.35	0.7 [0.39, 1.25]	.23
PGSI scores	0.2 (1.4)	0.2 (1.7)	-0.05	-0.09 [-0.3, 0.12]	.56
PGSI PG ^c	1.7%	2.3%	-0.1	0.91 [0.5, 1.63]	.74

^a Mean (SD) or %. ^b ES: Cohen's *d* or Odds Ratio, CI = Confidence Interval. ^c Reference level = yes.

^d Initially, there was a "don't know" response alternative. This response option was merged with the "no" option because it made no sense to separate the two.

Table 3 shows the intervention effects for the subordinates' pre-registered outcomes and for gambling policy. Gambling policy was the only significant intervention effect. Due to low incidence, the four categories of the PGSI had to be dichotomized for the outcome to be analyzed. Conforming to the cut-off criteria commonly used by the Public Health Agency of Sweden, PG was defined as a PGSI score of 3 or higher (Abbott et al., 2014). Supporting information, Table S8, shows other exploratory analyses of subordinate secondary outcomes that were not pre-registered.

The exploratory intervention outcomes that significantly favoured the intervention group at 12 months were knowledge of policies regarding (1) drugs, (2) gaming, and (3) medications.

DISCUSSION

For the primary outcome (manager's inclination), the intervention effect was not statistically significant at either the six- or 12-month follow-ups. One possible reason for this is that only 54% (131/242) of the managers in the intervention group participated in the skill-development training. When including only those who participated in training in the analysis, the intervention effect was significant at the 12-month follow-up, but still not at six months. Thus, focusing on increasing the uptake is a necessary factor for successful program implementation, but the current study could not establish if that would have been enough for success in this case. Another possible explanation is ceiling effects, as scores were generally high across all time points.

For the other outcomes, the results suggest that the proportion of managers who knew that a gambling policy existed increased more in the intervention group compared to the control group, at both six and 12 months. Next, when managers in the intervention group were concerned that an employee or colleague suffered from PG or OHU, they were more confident in how to act to support and performed more actions to provide support compared to managers in the waitlist group, at both six and 12 months. This indicates an increase in self-efficacy—the conviction that one can perform a behaviour required to produce a certain outcome (Bandura, 1977)—following the intervention. Because the skill-development training involved multiple practical and theoretical elements, participants may have gained self-efficacy from multiple sources. For example, the practical group exercises may have increased self-efficacy through all four sources suggested by Bandura: verbal persuasion from accepting to participate, mastery experiences from participating, affected emotional states from participating, and vicarious experiences from observing other participants.

Although it is easy to assume an association between the practical exercises and self-efficacy, earlier research also highlights the importance of basic information for behaviour change (Oakie et al., 2018; World Health Organization, 2004). The basic information elements of the skill-development training may have increased self-efficacy through verbal persuasion and affected emotional states. This corresponds well with the results from the interview study (Rafi et al., 2019) where several participants reported identifying with descriptions of cases. However, it is not possible to draw conclusions from this study on which elements were most effective, or if they interacted to increase self-efficacy.

For the outcome measure *Whom to consult regarding PG*, the effect was statistically significant only at 12 months. This may indicate a disseminating effect among the managers between the two follow-up occasions. The number of managers in the intervention group who claimed

that they acted to help increased significantly more in the intervention group at both follow-ups. This finding is of importance because it indicates behaviour change following the intervention, rather than introspective inclination only; however, the outcome of such actions remains unclear, as does the way the actions were perceived by subordinates. Lastly, managers' PGSI outcomes were not analyzed due to the low incidence. Unfortunately, it is not known whether the incidence was truly low or whether this was an effect of participants not wanting to disclose potential gambling harms. Exploratory analyses suggested an increase in manager's knowledge about PG, how to act regarding gaming, and knowledge of existing workplace policies for gambling and gaming, favouring the intervention. Despite being exploratory, the findings are in line with previous findings regarding alcohol policies (Pidd et al., 2018).

For the subordinates in the intervention group, there was no increased awareness after the intervention regarding *Whom to consult* if concerned about a colleague having PG or OHU. This is in line with the results of the qualitative interviews with the managers, which indicated that they had made no effort to disseminate any information to their subordinates (Rafi et al., 2019). The organizations would thus likely benefit from the intervention assigning certain managers a responsibility to share information with subordinates.

Next, there was no significant difference in *Worried about a colleague*. This is not surprising given the lack of other intervention effects for both managers and subordinates. Lastly, there was no change in PGSI scores or PGSI category among subordinates, which is unsurprising given the low incidence. However, it may also be the case that the use of PGSI as a measure of PG in a general working population does not adequately capture minor consequences of PG. The issue with measures of gambling-related consequences or harms has been recently discussed (Delfabbro & King, 2019). Essentially, gambling screeners need to identify minor harms that enables identification of gamblers before more serious harms can occur.

A measure such as the Short Gambling Harm Screen, which was recently developed to better capture harms among non-PG gamblers (Browne et al., 2018), would likely have been useful in the present study. Furthermore, another recent study (Cowlshaw et al., 2019) used item response theory to show that the PGSI mainly discriminates among higher levels of PG and also highlighted the need for measures that allow for identifying signs of low severity problems. As with the managers, exploratory analyses for the subordinates suggests their knowledge of existing workplace policies for drugs, gambling, gaming, and medications had increased favouring the intervention group.

Limitations

There were several limitations to this study. First, uptake of the skills-development training was poor, with only 54% of managers

participating, so it is unclear whether the lacking effects were due to the program or to the implementation.

Second, the quality of outcomes is questionable because all were collected through self-reports in questionnaires, with only one (*Acted to help*) indicating a behaviour. Because the skill-development training focused on skills, a proper evaluation should ideally include outcome measures that measure the skill quality. Indeed, this was underscored in the qualitative interviews conducted with participants in skill-development training (Rafi et al., 2019), which showed that despite enjoying the training, they struggled to remember its contents.

Third, the implications of the outcomes are unknown. For example, even if a manager acts to help an employee, it is unclear if and how the employee benefits from this. One way to address this would be to follow-up with these subordinates—though ethical issues would need to be resolved first.

A fourth limitation concerns the low response rate, particularly among subordinates. A mean response rate of 36.6% among subordinates across the organizations could affect the generalizability of the results. However, the mean response rate was much better among the managers at 59.2%. A meta-analysis of the response rate in organizations (Baruch & Holtom, 2008) reported that the average response rate was 52.7%.

Another possible limitation concerns the good-subjects effect where participants report improvement to please the researcher. However, with generally small between-group effects, the evidence for a good-subjects effect is low.

Regarding the statistical analysis, it would have been valuable to account for the clustering of subordinates to their managers, had such information been available. Such a model would provide more information of how managers differ in sharing information with their subordinates. Likewise, further information regarding the organization recruitment process would have been useful, although accepting to participate was likely a result of asking the right person at the right time.

The final limitation involves lack of fidelity in the measures of intervention delivery. Although fidelity checks would strengthen the results, implementing such controls would also involve considering the difference between fidelity and tailoring. Interviews with a sample of managers who participated in skill-development training revealed that the participants wanted the intervention to be tailored to their respective organizations (Rafi et al., 2019).

Conclusion

The aim of this study was to evaluate the potential effects of a workplace prevention program for problem gambling. The main outcome was managers' inclination to act when concerned about an employee's gambling. The intervention effect was only statistically significant at the

12-month follow-up for the subsample who attended skill-development training, but not when including non-attendees.

For managers who attend the skill-development training, the workplace preventive program seems to increase their inclination to act when concerned about an employee's gambling habits, but the results should be considered inconclusive until successfully reproduced. The workplace still seems to be a suitable application for PG interventions, and future research should continue to evaluate interventions independent of private interests, while also including longer follow-up measurements and more psychometrically valid outcome measures.

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Declaration of conflict of interest

The organization delivering the intervention, Alna, contracted authors 1 and 6 to perform the evaluation. Because the organization has a vested interest in the study outcomes, it did not participate in analyzing, interpreting, or reporting the study findings.

Author's contributions

Author 1 wrote the first draft of the manuscript. Authors 1, 5, and 6 participated in the data collection. All authors participated in completing the manuscript. Author 1 conducted the analyses. Author 6 initiated the project. Authors 1, 2, 3, and 6 participated in administrating the study. Author 4 provided valuable knowledge regarding organizational work.

Availability of data and materials

Data requests should be sent to the corresponding author.

Ethics and informed consent

The protocol was approved by the Regional Ethics Board in Stockholm, Sweden (2016/1208-31/5). All subjects gave written informed consent in accordance with the Declaration of Helsinki.

Clinical trial registration details

Clinical trials registration number: NCT02925286.

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Figure S1
CONSORT Flow Diagram

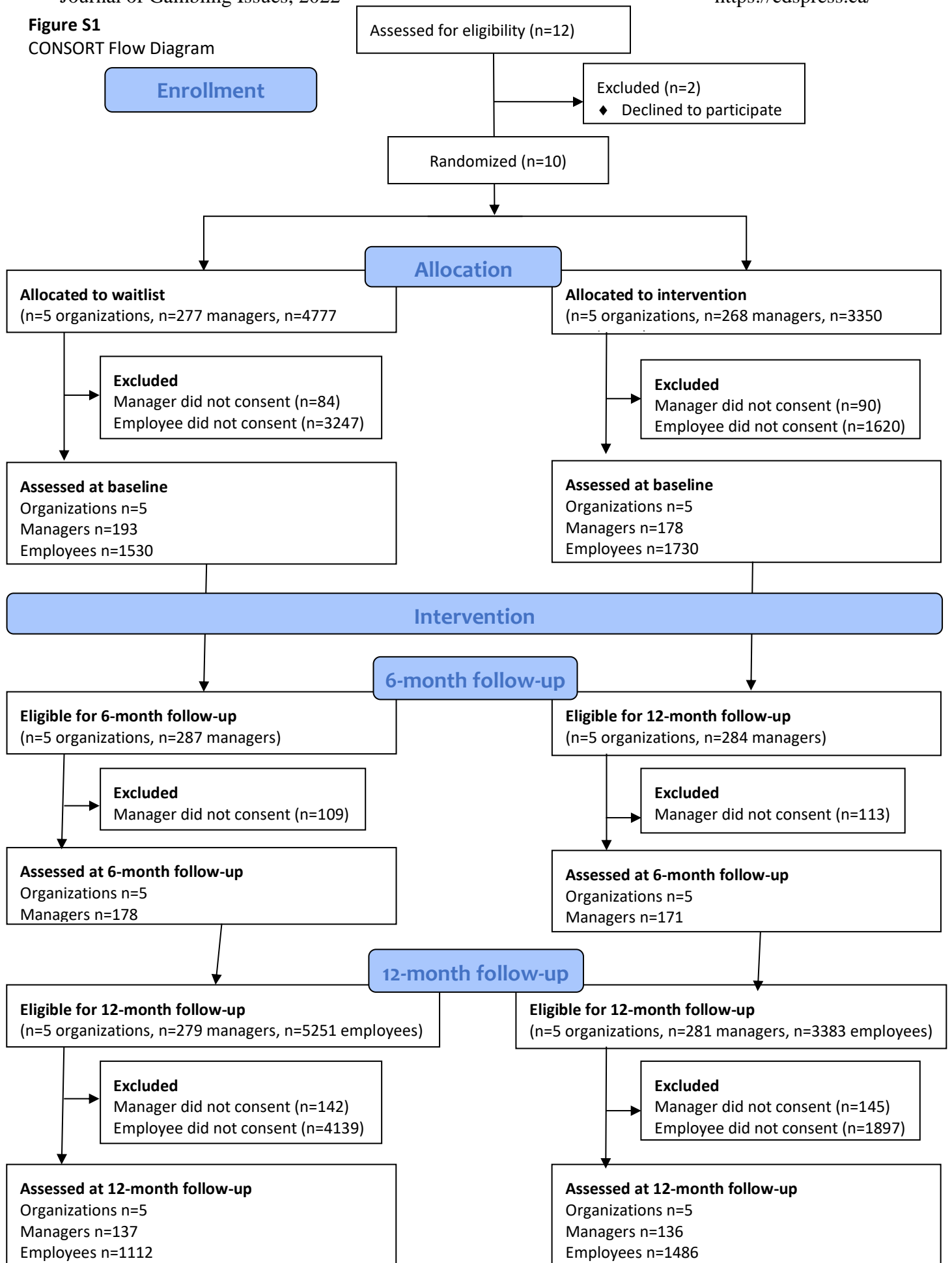


Table S1: Break-down of the Number of Manager and Subordinates Employed at Each Measurement Occasion.

Organization	Managers				Subordinates	
	Baseline	6 months follow-up	12 months follow-up	Employed at all 3 time points	Baseline	12 months follow-up
1	60	61 (10 new)	64 (10 new)	48	840	891 (139 new)
2	83	89 (25 new)	82 (1 new)	58	2048	2372 (383 new)
3	66	64 (3 new)	61 (7 new)	52	852	872 (140 new)
4	43	49 (6 new)	48 (5 new)	38	413	424 (37 new)
5	25	24 (1 new)	24 (0 new)	23	624	692 (146 new)
6	28	29 (2 new)	31 (3 new)	26	205	211 (27 new)
7	25	30 (8 new)	29 (5 new)	18	110	89 (59 new)
8	182	194 (28 new)	190 (13 new)	152	2570	2615 (416 new)
9	24	23 (1 new)	24 (2 new)	21	378	372 (89 new)
10	9	8 (0 new)	7 (1 new)	6	87	96 (17 new)
All	545	571 (84 new)	560 (47 new)	442	8127	8634 (1453 new)

Organizations 1-5 were in the intervention group, organizations 6-10 were in the waitlist group.

Table S2: Main topics covered during the two skill-development workshops

1. Different types of “use”: covers the difference between use, risk use, harmful use, and addiction, particularly regarding gambling.
2. Prevalence: statistics on the prevalence and change over time regarding gambling and problem gambling in Sweden.
3. Risk factors: risk and protective factors in the workplace, regarding problem gambling and other harmful use.
4. Conducting a conversation: the importance of using conversation as a tool. How to prepare, conduct, and evaluate a conversation regarding potential harmful use.
5. Signals: behaviors and signs that may signal problem gambling or other harmful use.
6. Workplace cultures and policies: how workplace cultures may relate to harmful use.
7. Benefits of having implemented workplace policies.
8. Roles and responsibilities: discussion of roles and responsibilities for the organization, managers, and employees.
9. Usage of the “checklist”: participants are shown the checklist and informed of its purpose.
10. Dilemmas: covers different dilemmas by discussing ambiguous cases.

Table S3: English Translation of Questionnaire.

[Information about the study, the survey, and Alna. Thereafter information about secrecy and the Personal Data Act]

1. I identify my gender as...

- Man Woman Other

2. What is your age category? **

- 16-24
 25-34
 35-44
 45-54
 55-64
 over 65

3. What role do you have in your organization? *

- Manager
 Supervisor

4. How long have you been employed in your current role? *

- Less than one year
 1-2 years
 3-5 years
 More than 5 years

5. Is there a written policy in your workplace that covers the following areas?

- Alcohol Yes No Don't know
Drugs Yes No Don't know
Gambling Yes No Don't know
Gaming Yes No Don't know
Illegal drugs Yes No Don't know

6. Do you know who it is best suited to refer to if you, a coworker or a manager has a harmful use that may lead to negative consequences in the workplace, in the following areas:

- Alcohol Yes No Don't know
Drugs Yes No Don't know
Gambling Yes No Don't know
Gaming Yes No Don't know
Illegal drugs Yes No Don't know

7. During the past 12 months, have you worried about a co-worker or manager because of a harmful use which could lead to negative consequences in the workplace, in the following areas:

- Alcohol Yes No
- Drugs Yes No
- Gambling Yes No
- Gaming Yes No
- Illegal drugs Yes No

8. During the last 12 months, have you in some way acted to help or support a co-worker or manager in a matter related to problems with gambling or other harmful use which can lead to negative consequences in the workplace? *E.g. by talking to the employee/manager, his/her manager, the HR or another part.*

- Yes No

9. How would you rate your own knowledge about gambling and problem gambling in the workplace? *Please answer using a scale from 1 to 10, where 1 means that you do not consider yourself having any knowledge on the subject, and 10 that you consider yourself having a lot of knowledge. **

No	1	2	3	4	5	6	7	8	9	10	High
Knowledge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	knowledge
e											e

10. Based on your role as a manager / supervisor, how confident do you feel about how you should respond to concern or suspicion of harmful use in the workplace? *Please respond using the below scale, where 1 means you feel very diffident, and 10 means you feel very confident. **

	<i>Very diffident</i>										<i>Very confident</i>
	1	2	3	4	5	6	7	8	9	10	
Alcohol	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drugs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gambling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gaming	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Illegal drugs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11. Based on your role as a manager / supervisor, how inclined are you right now to initiate a conversation with an employee when concern or suspicion of gambling problems or other harmful use? *Please respond using the below scale, where 1 means that you are not inclined to initiate a conversation, and 10 means you are very inclined to initiate a conversation. **

Not	1	2	3	4	5	6	7	8	9	10	Very
inclined	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	inclined

12. During the last 6 months, have you participated in an educational training conducted by Alna about gambling, problem gambling, and other harmful use in the workplace? *

Yes No Don't know

13. Do you know someone in your workplace who is gambling or gaming during work hours?

Gambling Yes No

Gaming Yes No

14. During the last 30 days, either during work or leisure time, have you gambled at an online operator? *E.g. online poker, internet casino, sports-betting etc.*

Yes, every week

Yes, very occasionally

No

Don't know/ Don't remember

15. During the last 30 days, either during work or leisure time, have you gambled at an offline operator? *I.e. any place where payment is not done online, such as a game kiosk, ATG-agent, casino, IRL betting etc.*

Yes, every week

Yes, very occasionally

No

Don't know/ Don't remember

16. During the last 12 months, either during work or leisure time, have you gambled at an online operator? *E.g. online poker, internet casino, sports-betting etc.*

Yes, every week

Yes, very occasionally

No

Don't know/ Don't remember

17. During the last 12 months, either during work or leisure time, have you gambled at an offline operator? *I.e. any place where payment is not done online, such as a game kiosk, ATG-agent, casino,*

Yes, every week

Yes, very occasionally

No

Don't know/ Don't remember

On the following page are some additional questions about gambling. Even if you do not gamble at all and perceive some questions as irrelevant, we kindly ask you to respond to all questions. Your answers are important to us!

[PGSI follows]

[Survey ends with a text field where participants may add a comment]

Notes: * question only present in the questionnaire for managers. ** Age category was chosen instead of exact age to increase sense of privacy since no analyses will be conducted that requires exact ages.

Table S4: Sensitivity Analysis. Primary Outcomes Analyzed Using Only the Sample of Managers Who Participated in the Skill-Development Training.

	<i>Observed values^a</i>		<i>Coefficient</i>	<i>ES (95% CI)^d</i>	<i>P-value</i>
	<i>Intervention^b</i>	<i>Control^c</i>			
Primary outcome					
Inclination					
12 months	8.2 (1.5)	7.4 (2.3)	0.67	0.31 (0.09, 0.52)	0.04
Secondary outcomes					
Inclination					
6 months	7.9 (1.5)	7.2 (2.4)	0.42	0.2 (-0.02, 0.41)	0.11
Policy Gambling ^e					
6 months	65.3%	15.2%	2.63	13.88 (3.6; 53.51)	< 0.001
12 months	73.7%	19.1%	2.81	16.69 (3.94; 70.68)	< 0.001
Who Gambling ^{e,f}					
6 months	91.7%	76.4%	0.49	1.64 (0.49; 5.52)	0.43
12 months	96%	77.4%	1.44	4.2 (0.89; 19.86)	0.07
Acted ^e					
6 months	23.1%	14.6%	1.98	7.21 (2.14; 24.36)	< 0.001
12 months	21.2%	13.9%	1.78	5.92 (1.62; 21.66)	0.01
How to act PG					
6 months	6.7 (1.9)	5.2 (2.5)	1.54	0.67 (0.45, 0.88)	< 0.001
12 months	6.9 (1.9)	5.7 (2.7)	1.19	0.32 (0.11, 0.54)	0.01

^a Mean (SD) or %. ^b 6-month n = 119, 12-month n = 79. ^c 6-month n = 178, 12-month n = 137. ^d ES: Cohen's d or Odds Ratio, CI: Confidence Interval. ^e Reference level: yes. CI = confidence interval. ^f Initially, there was a "don't know" response alternative. This response option was merged with the "no" option because it made no sense to separate the two.

Table S5: Managers and subordinates response rates split by occasion and group

Managers			
	Intervention	Waitlist	
Baseline	63.9% (178/277)	72% (193/268)	$(\chi^2 = 0.6, p = 0.43)$
6 months	59.6% (171/287)	62.7% (178/284)	$(\chi^2 = 0.1, p = 0.76)$
12 months	48.7% (136/279)	48.1% (137/281)	$(\chi^2 = 0, p = 1)$
Subordinates			
	Intervention	Waitlist	
Baseline	38% (1817/4778)	47.1% (1577/3350)	$(\chi^2 = 26.7, p < 0.001)$
12 months	30.4% (1594/5252)	34% (1150/3385)	$(\chi^2 = 6.3, p = 0.012)$

Table S6: Break-down of Manager Responses Split by Group, Baseline Response, and Occasion.

	<i>Intervention</i>		<i>Waitlist</i>	
	<i>Baseline response</i>	<i>Baseline non-response</i>	<i>Baseline response</i>	<i>Baseline non-response</i>
6 months follow-up				
Response	123	48	140	38
Non-response	42	4	38	6
12 months follow-up				
Response	97	39	104	33
Non-response	54	20	64	20

Table S7: Findings from Exploratory Analysis of Non-Preregistered Outcomes when Comparing Managers in the Intervention and Control Group.

	<i>Observed values^a</i>		<i>Coefficient</i>	<i>ES (95% CI)^d</i>	<i>P-value</i>
	<i>Intervention^b</i>	<i>Control^c</i>			
Colleague Gaming at Work					
6 months	17.5%	9%	0.44	1.55 (0.45; 5.27)	0.49
12 months	16.2%	6.6%	0.56	1.75 (0.42; 7.23)	0.44
Gambling Knowledge					
6 months	5.3 (2.1)	3.8 (2)	1.51	0.65 (0.44, 0.87)	< 0.001
12 months	5.7 (1.9)	4 (1.9)	1.72	0.69 (0.47, 0.91)	< 0.001
How to Act Alcohol					
6 months	7.7 (1.9)	8 (2)	0.3	0.3 (0.09, 0.52)	0.19
12 months	8.1 (1.5)	8.1 (2)	0.55	0.43 (0.21, 0.64)	0.05
How to Act Drugs					
6 months	7.1 (2.3)	7.4 (2.6)	0.33	0.19 (-0.02, 0.41)	0.41
12 months	7.9 (1.8)	7.7 (2.2)	0.67	0.21 (0, 0.42)	0.08
How to Act Gaming					
6 months	5.9 (2.3)	4.9 (2.7)	1.05	0.49 (0.28, 0.71)	< 0.001
12 months	6.6 (2.1)	5.6 (2.7)	0.87	0.15 (-0.06, 0.36)	0.02
How to Act Medications					
6 months	6.7 (2.1)	6.9 (2.5)	0.59	0.36 (0.15, 0.57)	0.07
12 months	7.2 (2)	7.2 (2.3)	0.69	0.27 (0.06, 0.48)	0.04
Policy Exists for Alcohol ^{e,f}					
6 months	90.6%	93.3%	1.59	4.9 (0.67; 35.75)	0.12
12 months	95.6%	94.9%	2.33	10.26 (0.94; 112.23)	0.06
Policy Exists for Drugs ^{e,f}					
6 months	70.2%	76.4%	0.44	1.55 (0.56; 4.28)	0.4
12 months	80.9%	81%	0.7	2.02 (0.63; 6.51)	0.24
Policy Exists for Gaming ^{e,f}					
6 months	43.9%	12.9%	1.9	6.72 (2.36; 19.11)	< 0.001
12 months	53.7%	19%	2.01	7.48 (2.47; 22.61)	< 0.001
Policy Exists for Medications ^{e,f}					
6 months	53.8%	46.1%	0.84	2.33 (1; 5.42)	0.05
12 months	58.1%	50.4%	0.84	2.31 (0.92; 5.79)	0.07
Who to Contact Regarding Drugs ^{e,f}					
6 months	90.6%	92.7%	-0.12	0.88 (0.21; 3.66)	0.86
12 months	98.5%	96.4%	0.98	2.66 (0.29; 24.29)	0.39
Who to Contact Regarding Gaming ^{e,f}					
6 months	83%	73%	0.14	1.15 (0.47; 2.79)	0.76
12 months	93.4%	75.2%	1.32	3.76 (1.21; 11.66)	0.02
Who to Contact Regarding Meds ^{e,f}					
6 months	91.8%	90.4%	0.05	1.05 (0.29; 3.85)	0.94
12 months	94.9%	94.2%	0.08	1.08 (0.23; 5.12)	0.92
Worried Alcohol ^e					
6 months	19.9%	31.5%	-0.32	0.73 (0.29; 1.81)	0.49
12 months	18.4%	26.3%	-0.15	0.86 (0.31; 2.37)	0.77
Worried Gaming ^e					
6 months	8.8%	7.3%	1.27	3.55 (0.55; 22.82)	0.18
12 months	11%	9.5%	1.25	3.48 (0.51; 23.48)	0.2
Worried Medications ^e					
6 months	8.8%	7.3%	0.83	2.3 (0.56; 9.39)	0.25
12 months	11%	9.5%	0.4	1.49 (0.36; 6.22)	0.59

^a Mean (SD) or %. ^b 6-month n = 171, 12-month n = 136. ^c 6-month n = 178, 12-month n = 137. ^d ES: Cohen's d or Odds Ratio, CI: Confidence Interval. ^e Reference level: yes. CI = confidence interval. ^f Initially, there was a "don't know" response alternative. This response option was merged with the "no" option because it made no sense to separate the two.

Table S8: Findings from Exploratory Analysis of Non-Preregistered Outcomes when Comparing Subordinates in the Intervention and Control Group at 12-month follow-up.

	<i>Observed values</i>		<i>Coefficient</i>	<i>ES (95% CI)^a</i>	<i>P-value</i>
	<i>Intervention (n=1594)</i>	<i>Control (n=1150)</i>			
Colleague Gaming at Work ^b	14.6%	9.4%	0.14	1.15 (0.92; 1.43)	0.21
Policy Exists for Alcohol ^{b,c}	63%	71.4%	0.08	1.08 (0.9; 1.3)	0.4
Policy Exists for Drugs ^{b,c}	48.6%	58.1%	0.18	1.2 (1.02; 1.42)	0.03
Policy Exists for Gaming ^{b,c}	25.9%	20.9%	0.28	1.32 (1.11; 1.57)	< 0.001
Policy Exists for Medications ^{b,c}	29.6%	33.8%	0.24	1.27 (1.07; 1.51)	0.01
Who to Contact Regarding Alcohol ^{b,c}	70%	76.9%	0.03	1.03 (0.86; 1.23)	0.78
Who to Contact Regarding Drugs ^{b,c}	67%	73%	0.05	1.05 (0.88; 1.24)	0.6
Who to Contact Regarding Gaming ^{b,c}	58.1%	58.8%	0.1	1.11 (0.96; 1.28)	0.17
Who to Contact Regarding Medications ^{b,c}	65.1%	70.8%	0.05	1.05 (0.9; 1.23)	0.55
Worried Drugs ^b	1.4%	0.8%	0.19	1.22 (0.68; 2.16)	0.51
Worried Gaming ^b	2.2%	1.8%	-0.15	0.86 (0.58; 1.28)	0.45
Worried Meds ^b	2.3%	2%	0.12	1.12 (0.73; 1.74)	0.6

^a ES: Odds Ratio, CI: Confidence Interval. ^b Reference level: yes. CI = confidence interval. ^c Initially, there was a “don’t know” response alternative. This response option was merged with the “no” option because it made no sense to separate the two.