ORIGINAL ARTICLE

A randomized controlled trial of the web-based drinking diary program for problem drinking in multi workplace settings

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Abstract

Objectives: To assess the effectiveness of a web-based brief intervention (BI) program to record daily drinking among people with problem drinking in workplace settings.

Methods: A two-armed, parallel-group, randomized controlled trial were conducted at six workplaces in Japan. After obtaining written consent to participate in the study, workers with an Alcohol Use Disorders Identification Test (AUDIT) score of 8 or higher were randomly assigned into two groups. The participants allocated to the intervention group recorded their daily alcohol consumption for 4 weeks using the program, while those allocated to the control group received no intervention. Outcome measures included the amount of alcohol consumption in past 7 days using the Timeline Follow-Back method in the program at baseline, 8th week, and 12th week and written AUDIT score at baseline and 12th week.

Results: Hundred participants were assigned to either the intervention group ($n = 50$) or control group ($n = 50$). The results of two-way repeated measures ANOVA showed a statistically significant interaction between the group and the week factors in the two primary outcomes (number of alcohol-free days, total drinks) and secondary outcomes (AUDIT score) ($p = .04$, .02, and .03, respectively). The between-group effect sizes (Hedges' g; 95% CI) of the outcomes at 12th week were 0.53; 0.13–0.93 (total drinks), 0.44; 0.04–0.84 (AUDIT score), 0.43; 0.03–0.83 (number of alcohol-free days).

Conclusions: The web-based BI program for problem drinking was considered to be effective in reducing alcohol consumption and the AUDIT score in workplace settings.

KEYWORDS
alcohol drinking, alcohol-related disorders, internet-based intervention, problem drinking, randomized controlled trial, workplace

1 | INTRODUCTION

Excessive alcohol consumption constitutes a risk factor for a large number of diseases, disabilities, and injury conditions.[1] The risk of all-cause mortality increases with increasing alcohol consumption, and all levels of alcohol consumption are considered potentially harmful.[2] Furthermore, problem drinking (a condition in which drinking has affected one's physical and mental health and social life; called risky drinking or heavy drinking in other literature and scoring 8 or higher on the Alcohol Use Disorders Identification Test [AUDIT][3,4]) affects family, friends, co-workers, and society in various ways.[5] For problem drinking, brief interventions (BI) at primary care and other health care settings are recommended based on their cost-effectiveness, as demonstrated by several studies.[6,7] BI is a brief behavioral counseling that aims at behavioral change in drinking habits. Interventions usually start with a conversation with the primary care provider and include feedback on the individual's alcohol use, information about the harms and benefits of reducing consumption, and advice on how to reduce consumption.[6,7]

However, BIs for problem drinking are not widely available in primary care and other health care settings because people with problem drinking are reluctant to seek medical attention, and health care providers are too busy to perform BIs.[8] Therefore, workplaces are gaining attention as promising intervention sites to provide BIs for problem drinking for those who do not seek treatment. It is said that 1 in 10 of all workers in a workplace needs some kind of intervention regarding alcohol issues,[9] and increased drinking by workers in the workplace not only worsens physical and mental illness, but also leads to absenteeism[10] and presenteeism.[11] Occupational physicians, nurses, or administrative staff interested in alcohol-related issues easily access, nudge, and monitor workers to improve their health conditions because both belong to the same organization. The advantages of the workplace as an intervention site may lead to more workers, including those reluctant to consult clinicians, and higher retention in interventions.[12] However, in many countries, interventions to address alcohol-related health issues in the workplace are not well implemented due to the lack of time, knowledge, and skills of occupational health care providers.[13]

Technology-based interventions (electronic brief interventions, hereafter referred to as eBIs) are promising forms to spread BIs into the workplaces. The advantages of eBIs are its ubiquity, anonymity, consistent quality, and lower cost than in-person BI.[14] Although some meta-analyses have shown the efficacy of eBIs,[15,16] few studies have examined the effectiveness of eBIs at workplaces.[17] Most of the subjects included in these meta-analyses were students or those who were recruited through web advertisements.

The purpose of this study was to assess the effectiveness and feasibility of implementing eBI in the workplace. Therefore, we developed a web-based BI program for problem drinking, Sensible and Natural Alcoholism Prevention Program for You: Diary On Computer (SNAPPY-DOC), and conducted a randomized controlled trial (RCT) to examine whether this program following a one-off face-to-face lecture on the effects of alcohol on health in a workplace setting, could reduce alcohol consumption more than a lecture alone.

2 | METHODS

2.1 | Study design

This study was a multi-site, two-arm, parallel-group RCT to assess the effect of the SNAPPY-DOC program (intervention group), compared with the assessment-only control group.

2.2 | Participants and setting

We conducted the study from August 2019 to July 2020 at six workplaces in Japan. Every six workplaces were different companies. Of those, three had resident occupational health professionals. The six workplaces were divided in four sectors: electrical engineering, transportation, construction, and steel industry. To recruit the workplaces, the authors went to academic conferences and seminars attended by occupational physicians, nurses, and administrative staff in charge of corporate health management. We then, distributed posters outlining this study along with invitations to lectures on the effects of alcohol on health at their workplaces. Later, a researcher (TS) gave a one-off 30-min, face-to-face lecture (about the amount of problem drinking, countermeasures against drunk driving, physical and mental harm caused by drinking, and introduction of various treatment methods to reduce alcohol consumption) at each workplace, and explained the study to them. The audience who wished to participate were asked to provide their written consent immediately after the one-off lecture (Week 0).

The inclusion criteria were (1) 20 years of age or older; (2) having regular access to the Internet, and being able to send and receive emails; and (3) scoring 8 or higher on the AUDIT. The exclusion criteria were those undergoing treatment for a severe physical or mental illness.

The AUDIT is a 10-item screening questionnaire developed by the World Health Organization. It represents a satisfactory compromise between sensitivity and specificity with a cutoff of 8 points.[3] In a meta-analysis conducted

by Riper et al. on the effect of eBI on problem drinking, many studies defined problem drinking as those with an AUDIT of 8 points or higher.[4] It is also said that an AUDIT of 8 points or higher increases the risk of mortality after 2–10 years.[18] Therefore, in this study, problem drinking is defined as those with an AUDIT of 8 points or higher. The eligibility check was undertaken via a face-to-face interview after obtaining informed consent.

2.3 | Sample size estimates

We preliminarily set the sample size for this study at 100 (50 per group) based on the effect size of previous studies and feasibility. If the sample size was 100 with the alpha error at 0.05 and the beta error of 0.2 (power, 80%), the detectable effect size was 0.57. A meta-analysis summarized the effect sizes of web-based, one-off individualized feedback programs for problem drinking as 0.27 (Hedges' g), that of multi-session interventions with individualized feedback as 0.61 (Hedges' g): the average effect size was 0.44 (Hedges' g).[15]

2.4 | Randomization and blinding

After baseline assessment, the eligible participants were randomly assigned to either the intervention group or the control group, using block randomization (the block size was fixed to 4). The random sequence was generated using the RAND function (Excel; Microsoft Corporation) by an independent researcher (HI). Enrollment was performed by TS who was concealed to the random sequence. The researcher (TS) managed the study progress, and sent emails to the participants (see the Intervention section below for information on when emails were sent).

It should be noted that the participants were not completely blinded. We did not explicitly tell the participants whether they were allocated to the intervention group or to the control group. However, they were told that they would be divided into two groups to record their daily alcohol consumption at different times over 3 months. The participants might be able to guess whether they were in the intervention or control group if they discussed the recording schedule with other participants in the same workplace.

2.5 | Description of the web-based brief intervention program (SNAPPY-DOC)

The SNAPPY-DOC program is a web-based program that allows users to reflect on their drinking habits, set goals for drinking, and record their daily drinking habits. A variety of web-based interventions for problem drinking have already been developed in other countries.[19] However, in Japan, the only web-based programs to address the issue of problem drinking were the single evaluations by AUDIT and websites to educate people about the hazards of drinking.[20,21]

We developed a program centered on self-monitoring (recording daily alcohol consumption), which is considered to be a low intensity and effective exercise among behavior change techniques for reducing alcohol consumption in previous studies.[22,23] We developed a prototype of this program in 2017. Then, we conducted a user test with around 50 medical and occupational health professionals to find improvements and refined the program to ensure the validity of the contents and enhance its functionality and usability in 2018. SNAPPY-DOC was operated on a server in Microsoft's data center in Japan, managed by the developer that produced the program. There were no bugs or downtimes during this study period, and we did not change the content of the program. The program was free of charge for the participants in this study.

2.6 | The flow of using the SNAPPY-DOC program

The participants logged in with their own ID and password, and recorded their alcohol consumption in the past 7 days, based on the Timeline Follow-Back (TLFB) method (Supporting Information 1). The TLFB method is an effective way to recall the recent drinking history.[24] Web versions of the TLFB method have been developed and adapted to a variety of substances with high reliability and validity.[25] These have been used in several intervention studies.[26–28]

After recording the data, the participants' (1) average drinks per drinking day in the past 7 days, (2) the number of alcohol-free days in the past 7 days, and (3) the total drinks in the past 7 days were displayed. Then, the participants set weekly drinking goals for each of the above (1)–(3), referring to low-risk drinking (about 20 g of pure alcohol per day) and high-risk drinking (more than 60 g of pure alcohol per day) as advocated in Japan.

When the participants entered their daily alcohol consumption, the date on the calendar was coded in five different colors according to the quantity of alcohol consumed on that day, providing visual feedback on how much they were drinking. At the same time, depending on the amount of daily alcohol consumption, a variety of feedback comments were displayed that were empathetic, encouraging, or praising the participants, based on the principles of cognitive behavioral therapy[29] and

motivational interviewing.[30] The degree to which the participants had achieved their weekly drinking goals was visually feedbacked on a calendar with three color-coded levels. Thus, the participants could receive feedback on two aspects of alcohol consumption: daily and weekly (Supporting Information 2).

In this program, an administrator can list an individual's entry history from the administration screen. Therefore, after confirming the first login date, a reminder email can be sent. Since this was a research project, the researcher (TS) sent four reminder emails every week after the first login. If this program is used in a workplace, occupational health staff can send reminder emails.

This program also included educational videos created by TS hosted on YouTube to help people learn about the physical and mental consequences of problem drinking (Supporting Information 3).[31]

2.7 | Intervention

2.7.1 | Intervention group

After obtaining study consent (Week 0), the participants assigned to the intervention group logged into SNAPPY-DOC (Week 0), and recorded their alcohol consumption in the past 7 days using the TLFB method. Subsequently, they used the program for 4 weeks to record their daily alcohol consumption. The participants were asked to record daily as far as possible.

During this time, the participants received an email every week that served as a reminder, and contained information regarding the following: personalized normative feedback based on AUDIT scores at baseline (Week 1), the benefits and harms of alcohol (Week 2), triggers for drinking (Week 3), and changes as a result of reducing alcohol consumption (Week 4).

2.7.2 | Control group

After obtaining study consent (Week 0), the participants assigned to the control group logged into SNAPPY-DOC (Week 0), and recorded their alcohol consumption in the past 7 days using the TLFB method. Unlike those in the intervention group, the participants assigned to the control group did not use SNAPPY-DOC to record their daily alcohol consumption for 4 weeks.

In both the groups, the amount of alcohol consumed in the past 7 days was recorded using the TLFB method in SNAPPY-DOC at 8th week (Week 8) and 12th week (Week 12) after the date of initial login (Week 0), and the AUDIT

was completed again in writing at 12th week (Week 12). If there was no login to SNAPPY-DOC at 8th and 12th week, the researcher sent a reminder email to the participant 1 week later requesting a record. If there was still no response, another week later, the researcher contacted the participants through the occupational health professionals or other personnel in their respective workplaces to request a record. At the end of the study, all participants were given individual feedback based on their daily alcohol consumption and AUDIT score, and given a gift card worth 3000 yen (about 28.4 USD). The flow of the study is shown in the Table 1.

2.8 | Study measures

The three primary outcomes were changes in the quantity of alcohol consumption in the past 7 days using the TLFB method from Week 0 to Week 8 and Week 12. Changes in the quantity of alcohol consumption were measured for the following three items.

1. Average drinks per drinking day in the past 7 days in standard units.
2. Number of alcohol-free days in the past 7 days.
3. Total drinks in the past 7 days in standard units.

The secondary outcome was change in the AUDIT score from Week 0 to Week 12. We chose a follow-up period of 12 weeks because the average follow-up period of previous studies on eBI overseas[16] was 12 weeks and because of feasibility.

We collected data on the participants' demographics and characteristics related to alcohol use at baseline (Week 0). We also collected the following usage variables: whether keeping track of their daily drinking in the SNAPPY-DOC for 4 weeks in the intervention group; whether reminded by the occupational health professionals or other personnel to record their alcohol consumption at Week 8, or Week 12.

2.9 | Statistical analysis

We compared the demographics and the characteristics of the participants between the two groups. Categorical data were expressed using frequencies, and the differences between the two groups were compared using Fisher's exact test. Continuous data were expressed using mean and standard deviations, with a comparison of data between the two groups using an independent t-test.

The outcome scores of all evaluations were analyzed by using two-way repeated measures ANOVA with one

TABLE 1 Flow of the intervention and control groups

Timepoint	Enrollment SE (=week 0)	Start Week 0	Post-allocation Week 1	Week 2	Week 3	Week 4	Follow-up Week 8	Week 12	After the study
Enrollment									
Explanation	X								
Informed Consent	X								
Eligibility check	X								
Randomization	X								
Interventions									
Intervention group									
Record daily alcohol consumption		←————————————————→							
Receive reminder emails			X	X	X	X			
Control group (no intervention)									
Assessments									
Demographic questions	C + I								
AUDIT	C + I							C + I	
TLFB		C + I					C + I	C + I	
Written feedback									C + I
Gift card									C + I

Abbreviations: AUDIT, Alcohol Use Disorders Identification Test; C, control group; I, intervention group; SE, study entry; TLFB, Timeline Follow-Back.

between-factor (group) and one within-factor (Week 0, Week 8, and Week 12). To account for multiple comparisons with respect to follow-up times (Week 0, Week 8, and Week 12), p-values were adjusted according to the Holm method. We calculated Hedges' g to measure the effect size. All Hedges' g were expressed as absolute values of changes (positive values).

One researcher (HI) downloaded the data from the SNAPPY-DOC database, and masked the group variable before analysis. Subsequently, the researchers (TS, ES) analyzed the final data. All statistical analyses were conducted according to the intention-to-treat principle, using R version 4.0.2. The differences were considered significant at $p < .05$.

2.10 | Ethical procedures

Written informed consent was obtained from all participants. When obtaining informed consent, we notified the participants that their daily record of alcohol consumption would not be shared with the personnel of their workplace, but with the researchers, and asked them to participate of their own will. We also explained to them

that they could withdraw from the study at any time if they so desired. We also informed them that if they did not have access to the program by the deadline, they would be contacted verbally by the person in charge of their workplace, unless they withdrew from the study. We also explained that all participants, regardless of their assigned group, would receive individual written feedback on their alcohol consumption at the end of the study.

3 | RESULTS

3.1 | Participant flow and follow-up

Figure 1 shows the participant flow diagram. A total of 292 participants attended the one-off 30-min face-to-face lecture, and 100 participants were recruited and randomly assigned to either the control group ($n = 50$) or the intervention group ($n = 50$). All the participants logged into the SNAPPY-DOC, and no participants dropped out from the follow-up. The following was an overview of the six companies that participated in this study. (Table 2).

3.2 | Baseline data

The demographics and the characteristics of the participants were analyzed (Table 3). The participants were predominantly middle-aged men. No significant differences were observed between the two groups for any of the demographic and characteristic variables.

3.3 | Outcomes

All the 50 participants in the intervention group recorded their daily drinking for 4 weeks using the SNAPPY-DOC. In Week 8, or Week 12, five participants in the control group and six participants in the intervention group were verbally instructed by occupational health professionals or other personnel to respond to the follow-up surveys because they did not finish answering them by the due date.

The results of the two-way repeated measures ANOVA (Table 4) showed that there was a statistically significant main effect of the Week factor on all the four outcomes. There was a statistically significant interaction between the Group and Week factors in the two primary outcomes: number of alcohol-free days in the past 7 days, total drinks in the past 7 days in standard units, and the secondary outcome (AUDIT score). There was no interaction between the Group and Week factors in one of the primary outcomes (average drinks per drinking day in the past 7 days in standard units).

The changes in the primary and the secondary outcomes over time for each group are shown in Table 5. The control group indicated an improvement in all the three primary outcome measures, but this was not statistically significant. The intervention group revealed a statistically significant improvement in all the three primary outcome measures. Both the groups demonstrated a statistically
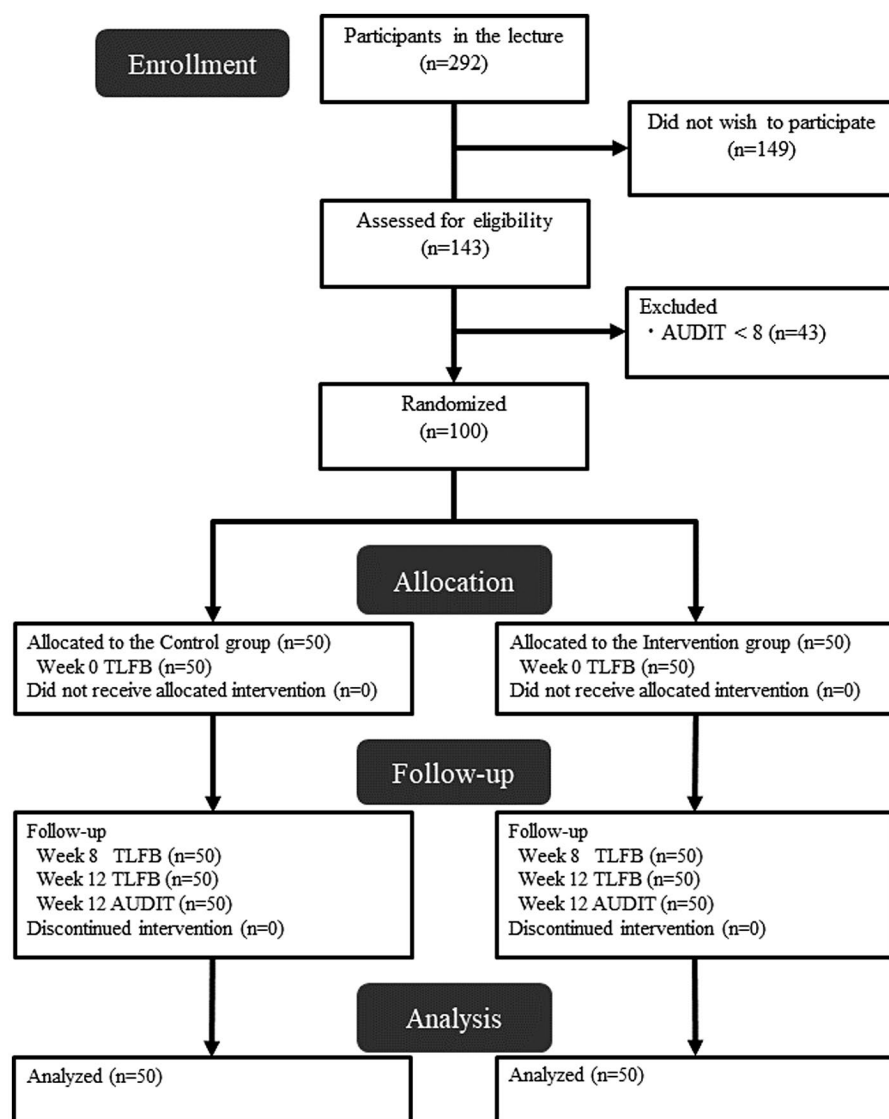

FIGURE 1 The flow of participants through the study protocol (CONSORT Flow Diagram). Abbreviations: AUDIT, Alcohol Use Disorders Identification Test; TLFB, Timeline Follow-Back

TABLE 2 Overview of the six companies included in the study

Company	Sector	Number of workers (approx.)	Participants in the lecture	Participants in the study	Resident occupational health professionals
Company A	Electrical engineering	60	21	10	No
Company B	Transportation	70	38	10	Yes
Company C	Construction	80	32	15	No
Company D	Construction	50	35	8	No
Company E	Steel industry	700	65	25	Yes
Company F	Transportation	500	101	32	Yes

TABLE 3 Baseline characteristics of participants ($n = 100$)

Participant characteristics		Control group $n = 50$	Intervention group $n = 50$	p value
Gender	Male, n (%)	44 (88%)	46 (92%)	.74
Age	Mean (SD)	46.4 (10.3)	45.6 (11.5)	.71
AUDIT score	Mean (SD)	13.2 (4.9)	13.9 (6.1)	.57
Average drinks per drinking day in the past 7 days in standard units[a]	Mean (SD)	6.5 (6.1)	6.1 (3.6)	.66
Number of alcohol-free days in the past 7 days	Mean (SD)	1.7 (1.7)	1.2 (1.5)	.14
Total drinks in the past 7 days in standard units[a]	Mean (SD)	29.4 (16.1)	32.9 (18.6)	.32
Being advised to reduce alcohol consumption	Yes, n (%)	10 (20%)	11 (22%)	1.00
Wanting to reduce alcohol consumption	(1) Always, n (%)	4 (8%)	5 (10%)	.44
	(2) Sometimes, n (%)	28 (56%)	20 (40%)	
	(3) Not often, n (%)	15 (30%)	19 (38%)	
	(4) Not at all, n (%)	3 (6%)	6 (12%)	
Confidence to reduce alcohol consumption[b]	Mean (SD)	5.0 (2.7)	4.7 (2.6)	.68
Life changes by reducing alcohol consumption[c]	Mean (SD)	5.7 (2.0)	5.8 (2.3)	.85

Abbreviations: AUDIT, Alcohol Use Disorders Identification Test; SD, Standard Deviation.
[a]A standard unit of alcohol contains 10 g of ethanol.
[b]On a scale from 0 to 10, from "completely unsure" to "highly confident".
[c]On a scale from 0 to 10, from "hopeless" to "great life".

significant improvement in the secondary outcome of the AUDIT score.

The control group had reduced alcohol consumption by 18 g (from 294 g to 276 g) per week on average at the 12-week evaluation. The intervention group had reduced alcohol consumption by 83 g (from 329 g to 246 g) per week on average at the 12-week evaluation. This meant that, on an average, the control group's reduction in consumption was 65 g per week less than the intervention group's at Week 12. The between-group effect sizes (Hedges' g; 95% CI) of the primary and secondary outcomes at Week 12 were 0.53; 0.13–0.93 (total drinks), 0.44; 0.04–0.84 (AUDIT score), 0.43; 0.03–0.83 (number of alcohol-free days), and 0.004; −0.39 to 0.40 (average drinks per drinking day).

4 | DISCUSSION

4.1 | Brief summary

We evaluated the effectiveness of an eBI (SNAPPY-DOC) on changes in drinking behaviors after 12 weeks of follow-up with 100 participants at six workplaces. To the best of our knowledge, although a study examining the effectiveness of face-to-face BI for problem drinking has been conducted in Japan,[32] there have been no studies on eBIs with continuous therapeutic interventions, except for a protocol paper on a single intervention.[33] This study was the first RCT to investigate the effectiveness of an eBI for problem drinking conducted in the workplace in Japan.

TABLE 4 Summary of the results of the two-way repeated measures ANOVAs performed to analyze the effects of Group (G), Week (W), and the interaction (G×W) between these two factors on the outcomes studied in this study

Outcome	Factor	SS	DF	*F* value	*p* value	
Average drinks per drinking day in the past 7 days in standard units[a]	Group (G)	16.6	1	.46	.50	
	Week (W)	67.5	2	6.09	<.01	*
	G × W	0.1	2	.008	.99	
Number of alcohol-free days in the past 7 days	Group (G)	0.1	1	.01	.91	
	Week (W)	24.5	2	10.95	<.01	*
	G × W	7.5	2	3.35	.04	*
Total drinks in the past 7 days in standard units[a]	Group (G)	56.0	1	.07	.79	
	Week (W)	1446.0	2	7.84	<.01	*
	G × W	704.0	2	3.82	.02	*
AUDIT score	Group (G)	0.2	1	.003	.96	
	Week (W)	188.2	1	37.16	<.01	*
	G × W	24.5	1	4.84	.03	*

Abbreviations: AUDIT, Alcohol Use Disorders Identification Test; DF, Degrees of Freedom; *F*-value, Fisher's *F* ratio; *p*-value, probability of *F*; SS, Sum of Squares.

[a]A standard unit of alcohol contains 10 g of ethanol.

*Significance ($p < .05$).

TABLE 5 Alcohol consumption and AUDIT score at baseline and follow-up by treatment status

	Control Group (*n* = 50)		Intervention Group (*n* = 50)		Between-group effect size	
	Mean (SD)	*p* value	Mean (SD)	*p* value	Hedge's *g*	95% CI
Average drinks per drinking day in the past 7 days in standard units[*]						
Week 0	6.5 (6.1)	Ref	6.1 (3.6)	Ref	Ref	Ref
Week 8	5.4 (3.1)	.34	4.9 (3.1)	.02[a,*]	0.02	−0.37 to 0.41
Week 12	5.8 (3.8)	.34	5.3 (3.2)	.048[a,*]	0.004	−0.39 to 0.40
Number of alcohol-free days in the past 7 days						
Week 0	1.7 (1.7)	Ref	1.2 (1.5)	Ref	Ref	Ref
Week 8	1.7 (1.6)	.92	1.9 (1.9)	.01[a,*]	0.43	0.03–0.82
Week 12	2.0 (1.8)	.12	2.2 (2.0)	<.01[a,*]	0.43	0.03–0.83
Total drinks in the past 7 days in standard units[*]						
Week 0	29.4 (16.1)	Ref	32.9 (18.6)	Ref	Ref	Ref
Week 8	28.5 (19.9)	1.00	25.4 (18.1)	<.01[a,*]	0.45	0.05–0.85
Week 12	27.6 (19.8)	.83	24.6 (16.3)	<.01[a,*]	0.53	0.13–0.93
AUDIT score						
Week 0	13.2 (4.9)	Ref	13.9 (6.1)	Ref	Ref	Ref
Week 12	12.0 (5.8)	<.01[a,*]	11.2 (5.1)	<.01[a,*]	0.44	0.04–0.84

Abbreviations: AUDIT, Alcohol Use Disorders Identification Test; SD, Standard Deviation.

[a]A standard unit of alcohol contains 10 g of ethanol.

*$p < .05$: Paired *t*-test (post-hoc Holm tests for comparisons with the baseline).

As shown in Table 2, the participation rates in the one-off lecture and the present study were comparable between small workplaces with and without occupational health professionals. The results suggest that the SNAPPY-DOC program following the one-off lecture can be implemented in workplaces regardless of the presence of occupational health professionals.

We found a statistically significant reduction in alcohol consumption (number of alcohol-free days in the past 7 days, and total drinks in the past 7 days in standard

units), and in the AUDIT score in the intervention group compared to the control group. The SNAPPY-DOC program appeared to reduce the total weekly alcohol consumption by increasing the alcohol-free days rather than by decreasing the average drinks per drinking day.

4.2 | Comparison with previous studies

The effect size of the SNAPPY-DOC program was similar to those in a meta-analysis that investigated the effectiveness of eBIs on problem drinking.[4] In terms of weekly alcohol consumption, the Hedges' g of multi-component eBIs was around 0.50, and that in the present study was 0.53.

Similar to a meta-review of previous studies,[16] this study found a reduction in weekly alcohol consumption in the intervention (eBI) group rather than in the control group. This review showed that the majority of studies were conducted on college students and web advertising participants, and the between-group differences in changes in weekly alcohol consumption were about 43.3 g (range = 13.4–73.2) at 2–3 months. On the other hand, the between-group difference in changes in weekly alcohol consumption in our study was 65 g. Our findings suggested that, as it was in college students and web advertising participants, eBI was as effective in the workplace.

In this study, the number of alcohol-free days in the intervention group was significantly higher than that in the control group, whereas there was no significant between-group difference in the average drinks per drinking day. This pattern of reduced alcohol consumption was consistent with the results of a previous RCT in Japan[32] but differed from the results of meta-analyses of RCTs overseas.[16] In a meta-analysis of RCTs overseas, both the frequency of drinking and average drinks per drinking day were significantly decreased. In Japan, there is a custom of having regular "alcohol-free days" to recover liver function by periodic abstinence. Because of this cultural background, the pattern of drinking reduction, where the number of alcohol-free days increased and the average drinks per drinking day did not decrease, might be unique to Japan.[32]

Also noteworthy in this study was that all the participants completed 12 weeks of follow-up, while, on average, 35% of the participants dropped out from previous studies conducted online recruiting students or those who saw the advertisements.[15,34] The reasons for the high retention rate of this study might be explained as follows: (1) we held a lecture on the effects of alcohol on health before the explanation of the study, and established a relationship of trust between the participants and the researchers; (2) the occupational health professionals or other personnel in their respective workplaces contacted the participants who had not recorded responses in time; (3) the intervention was only recording daily alcohol consumption; (4) we ensured that the records of individual participants' alcohol consumption were shared only between the participant and the researcher, and were not known to the workplace, hence reducing the participants' psychological resistance in recording their alcohol consumption and allowing them to self-disclose[35]; (5) the short intervention period of 12 weeks made it easy to follow-up; (6) we gave each participant a written feedback on their alcohol consumption after the study; and (7) we provided them with a gift card worth 3000 yen (about 28.4 USD) as monetary compensation.

4.3 | Possible explanations and implications

The results of this study suggested that eBIs for problem drinking in the workplace were effective in reducing alcohol consumption. This study was not conducted entirely online, as lectures, explanations of the study, and obtaining consent happened face-to-face, and the staff at each workplace directly approached the participants to respond to the follow-up surveys. However, only 11 out of 100 participants needed to be verbally instructed. All 50 participants in the intervention group completed the intervention (recording their daily drinking for 4 weeks in the SNAPPY-DOC) with only an email reminder from the researcher. Therefore, eBIs for problem drinking following a brief lecture at workplaces showed high retention rates and effectiveness in reducing alcohol consumption among workers with minimal involvement of occupational health providers.

4.4 | Limitations

This study had five major limitations. First, the intervention was evaluated solely on self-reported outcomes related to the quantity of alcohol consumed and not by objective outcomes (e.g., liver function), although the validity and reliability of self-reporting of alcohol outcomes via the Internet in clinical trials were confirmed.[36] Second, there was the issue of a short follow-up period. We demonstrated effectiveness of the intervention on the reduction of alcohol consumption at the 12-week follow-up. Although this was in line with the average follow-up period of previous studies,[16] it might be insufficient to assess the effects of reduced drinking on some aspects of the physical and mental status. Third, as described in the "Randomization and

Blinding" section of the Methods, this study might not have been completely blinded to the participants. We did not explicitly inform the participants whether they were assigned to the intervention or control group. However, participants could guess whether they belonged to the intervention or control group by discussing the recording schedule with other participants in the same workplace. Fourth, the results of this study could not be generalized to other workplaces. This is because the study was conducted in the workplaces where there were occupational physicians, nurses, or administrative staff interested in alcohol-related issues, and most of the participants were men who had a certain level of web literacy. Fifth, the participants in this study might have been skewed toward workers who were highly motivated among those with AUDIT scores of 8 or higher. This was because the participants in this study were recruited voluntarily in their respective workplaces.

5 | CONCLUSIONS

This study demonstrated that eBI following a one-off face-to-face lecture for problem drinking was moderately effective with a follow-up period of 12 weeks compared to a lecture alone and implementable in a workplace setting without any dropouts. Further studies are needed to investigate the long-term effects of reducing alcohol consumption on objective outcomes such as laboratory tests, which may be available by obtaining the results of annual health check-ups in more diverse workplaces.

DISCLOSURE
Approval of the research protocol: This study was approved by the Institutional Review Board of Saga University Faculty of Medicine Graduate School of Medical Sciences (30–36), Saga Prefecture Medical Center Koseikan (19-2-01-03), and National Hospital Organization Hizen Psychiatric Center (30–37). *Informed Consent*: Written informed consent was obtained from all participants in this study. *Registry and the Registration No. of the study/trial*: This clinical trial was registered in the University Hospital Medical Information Network Clinical Trials Registry UMIN000037698; https://upload.umin.ac.jp/cgi-open-bin/ctr_e/ctr_view.cgi?recptno=R000042703. *Animal Studies*: N/A.

AUTHOR CONTRIBUTIONS
The study was designed by TS, RS, HI, ES, TU, TY, and AM. The content of the SNAPPY-DOC program was developed by TS, RS, TU, and TY. TS managed the progress of the study. Statistical analysis was performed by TS and ES. Funding was obtained by TS, TU, and TY. The initial draft manuscript was written by TS. All the authors revised and contributed to writing the final manuscript. All the authors read and approved the final manuscript for publication.

DATA AVAILABILITY STATEMENT
The data underlying this article cannot be shared publicly due to the privacy of individuals that participated in the study. The data will be shared on reasonable request to the corresponding author.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.