



Self-Regulatory Strategies Reduce Gambling Spend and Harm in a Randomised Controlled Trial of Electronic Gaming Machine Players

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Abstract

Research provides insights into the self-regulatory strategies (SRSs) gamblers use, but evidence supporting their efficacy is weak. Study 1 aimed to identify a set of SRSs that best predict less harmful gambling amongst electronic gaming machine (EGM) players who are most vulnerable to EGM-related harm. Study 2 aimed to test their efficacy as a brief intervention in a randomised controlled trial. Study 1 surveyed 2032 EGM players and compared SRS-use amongst harmed and less-harmed players after propensity matching and weighting. Study 2 delivered 13 efficacious SRSs identified in study 1 as a brief intervention in a three-wave RCT and assessed their effect on time and money spent on EGMs and EGM-related harm. In study 1, the individual use of 17 SRSs and the total count of these SRSs used were associated with lower EGM-related harm. In study 2, *assignment* to three SRSs resulted in reduced EGM spend, with no detectable effects for 10 other SRSs. More frequent reported *use* of one of the same SRSs and an additional two SRSs also resulted in reduced EGM spend and/or reduced EGM-related harm. The results provide new evidence about the efficacy of certain SRSs to result in beneficial gambling outcomes: setting aside a fixed amount to spend, taking regular breaks, keeping leisure time busy with other activities, not gambling due to boredom, and keeping a household budget. These SRSs could be communicated as actionable strategies people can use to help reduce gambling harm.

Keywords Gambling harm · Electronic gaming machines · Self-regulatory strategies · Behavioural change strategies · Protective behavioural strategies

Most gambling harm is attributable to electronic gaming machines (EGMs) because of their inherently risky design features, such as high speed of betting, and relatively high participation rate (Browne et al., 2023). Importantly, EGM-related harm is not confined only to players with a clinically diagnosable gambling disorder, but also extends to those experiencing less severe gambling problems (Browne et al., 2016, 2017; Canale et al., 2016; Salonen et al., 2018). Few people with a severe disorder seek professional gambling treatment before a crisis point, and low-moderate risk gamblers rarely use formal help even when experiencing gambling harm (Bijker et al., 2022). However, gamblers are generally

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more amenable to using self-regulatory strategies (SRS) to control their gambling and believe they are able to implement them (Bagot et al., 2021; Hing et al., 2012; Lubman et al., 2015). It is therefore important that SRSs promoted to gamblers are evidence-based as part of a broad suite of public health measures aimed at safer gambling consumption, products, environments, and policies.

Self-regulatory gambling strategies have been conceptualised as two categories that seek broadly different goals (Rodda et al., 2019): (1) behaviour change strategies to reduce, regain control over, and resolve an existing gambling problem and (2) protective behavioural strategies to prevent gambling harm from occurring by limiting and maintaining control over gambling. In practice, these two types of SRSs show considerable overlap, as evident below.

Behaviour Change Strategies

Research has explored strategies used to regain control over gambling and address a gambling disorder. In a study of 43 'resolved problem gamblers' (Hodgins & El-Guebaly, 2000), commonly used strategies included stimulus control, treatment seeking, cognitive strategies and social support. In a focus group study (Thomas et al., 2010), higher-risk gamblers reported they required intensive strategies like abstinence, replacing gambling with healthier activities and help-seeking, whereas lower-risk gamblers reported that setting limits, maintaining awareness and keeping gambling social were sufficient to maintain control. A survey of 238 'social gamblers' and 68 'problem gamblers' identified five types of strategies: cognitive approaches, direct action, social experience, avoidance and limit setting (Moore et al., 2012). Participants with a gambling problem who were actively trying to reduce their gambling were the most likely to use the strategies. However, while setting limits is a common strategy, higher-risk gamblers report relatively lower adherence to this strategy (Abbott et al., 2014; Thomas et al., 2010).

Rodda et al. (2017); Rodda, Hing, et al. (2018b) analysed online counselling sessions and forum posts related to problem gambling. They identified six primary change strategies: cash control, social support, avoiding or limiting gambling, engaging in alternative activities, changing thoughts and beliefs and self-assessment and self-monitoring. They then administered an inventory of 99 behaviour change strategies to 489 people who had experienced a gambling problem (Rodda, Bagot, et al., 2018a). Those meeting criteria for past-year problem gambling reported all strategies as more helpful compared to lower-risk gamblers, except for planning and financial control strategies. The problem gambling group rated cognitive strategies as most helpful, such as reminding themselves of the consequences of gambling. Conversely, non-problem gamblers reported that setting financial limits was most helpful (Knaebe et al., 2019).

Protective Behavioural Strategies

Several studies have focused on protective behavioural strategies to limit gambling, stay in control and prevent harmful consequences. Lostutter et al. (2014) administered the Gambling Protective Behavior Scale to 1922 US college student gamblers. Harm reduction strategies, such as resisting chasing losses and keeping track of spending, were associated with lower gambling quantity and problem gambling severity.

Avoidance strategies, such as not carrying bank cards and refraining from gambling when feeling down, were associated with lower gambling frequency but not quantity or problem severity. These results suggest that higher-risk gamblers seeking to abstain from gambling may be more likely to use avoidance strategies, whereas lower-risk gamblers prefer harm reduction strategies. Amongst 860 regular gamblers in Victoria Australia (Hing et al., 2017), lower-risk gamblers were more likely to report using harm reduction strategies, including setting limits, gambling for pleasure rather than to win money and balancing gambling with other activities.

Wood and Griffiths (2015) examined ‘positive play’, based on players who do not report problematic gambling behaviours. Their Positive Play Scale (Wood et al., 2017) identified four factors—honesty and control, pre-commitment, personal responsibility, and gambling literacy—which correlate negatively with disordered gambling (Delfabbro et al., 2020; Tabri et al., 2020; Tong et al., 2020). However, the scale mostly assesses responsible gambling beliefs, rather than a set of actionable strategies that gamblers can adopt. Rodda et al. (2019) investigated the strategies that 184 gamblers used to adhere to their limits on EGMs. Lower-risk gamblers used certain strategies more frequently, such as avoiding chasing losses and viewing gambling as entertainment. Higher-risk gamblers more frequently asked family or friends to look after cards or cash in the venue. Finally, Hing et al. (2019) surveyed 1174 gamblers in Canada to assess 43 potential SRSs. Certain strategies, such as stopping gambling if it is not enjoyable and setting a dedicated gambling budget, predicted lower gambling harm. Conversely, strategies including researching gambling strategies and using gambling to make money were linked to increased harm.

Gaps in Current Evidence

Prior research provides useful insights into the SRSs that gamblers use. However, the evidence base supporting their efficacy is weak due to several design limitations. First, all studies have been cross-sectional, identifying correlations but not causation between SRS-use and subsequent gambler-risk status. Second, findings are obscured by conceptual overlap between behaviour change strategies and protective behavioural strategies (Rodda et al., 2019). This may explain why conflicting results exist for whether lower-risk or higher-risk gamblers are more likely to use SRSs. Some SRSs tend to be used only by people with a gambling problem who want to reduce their gambling, such as avoidance, cognitive and help-seeking strategies. Thus, whether lower-risk gamblers use more or fewer SRSs than higher-risk gamblers depends on the set of strategies measured. Third, including SRSs used only by people wanting to address a gambling problem further obscures results because their use correlates with higher-risk rather than lower-risk gambling. Less frequent gamblers may not use some strategies simply because they have no need to do so. This indicates the importance of focusing research on players who are vulnerable to experiencing gambling harm. Otherwise, including gamblers not needing to use SRSs is likely to cloud results. Finally, the purpose of protective behavioural strategies is to minimise harm from gambling, but only two studies have included a measure of gambling harm (Delfabbro et al., 2020; Hing et al., 2019). The current study attempted to overcome these limitations.

The Current Study

The two studies presented here were conducted in the Australian state of New South Wales (NSW) where EGMs are legally available only in land-based clubs, hotels and casinos (and not online). Study 1 aimed to identify a set of SRSs that best predict less harmful gambling amongst EGM players who are most vulnerable to EGM-related harm. Its specific objectives were to (a) examine the use of SRSs, (b) identify the most efficacious SRSs and (c) examine the use of the most efficacious SRSs and by personal characteristics (age, gender, PGSI and EGM frequency). These findings informed study 2 which aimed to test the efficacy of the most efficacious SRSs from study 1 as a brief intervention in a randomised controlled trial. The objectives for study 2 were to examine the effects on three outcome variables (expenditure on EGMs, time spent playing EGMs, and harm from EGM play) of (a) the assignment of any treatment condition vs the control condition, (b) the assignment of the individual SRSs vs the control condition and (c) the frequency of SRS utilisation.

Study 1: Survey of EGM Gamblers

Methods

Study 1 was approved by Central Queensland University Human Research Ethics Committee (#22741).

Recruitment

Online panel aggregator, Qualtrics, recruited participants via online convenience panels in November and December 2020. Potential participants were emailed a link to an information sheet and online survey. The population of interest was regular EGM gamblers, that is, people who are most likely to experience harm from EGM use, who lived in the state of the funding body. Inclusion criteria were informed consent, living in NSW, aged 18 years or older and gambling on EGMs at least monthly. Of the 2053 respondents who fully completed the survey, 21 were removed for failing quality checks that assessed attention and straight-lining through questions. This left 2032 participants for analysis.

Measures

Where relevant, measures referred to the most common terminology for EGMs in NSW, the 'pokies'.

Self-Regulatory Strategies (SRSs) Participants were asked their agreement or disagreement to using each of 45 SRSs in relation to their pokies gambling (Table 2). The SRSs were distilled from a comprehensive list of SRSs promoted to gamblers and assessed in prior research (Hing et al., 2019; Hing, Russell, & Hronis, 2016b) and further refined based on recent research (Rodda et al., 2019; Rodda, Hing, et al., 2018b).

The *Problem Gambling Severity Index* (PGSI; Ferris & Wynne, 2001) was administered in relation to the last 12 months. We used the validated scoring of 'never' = 0, 'sometimes' = 1, 'most of the time' = 2 and 'almost always' = 3, and the validated categories of

'non-problem gambler' = 0, 'low-risk gambler' = 1–2, 'moderate-risk gambler' = 3–7 and 'problem gambler' = 8–27. Cronbach's alpha was .95.

GHS The Short Gambling Harms Screen (SGHS; Browne et al., 2018) and the Unimpeachable Gambling Harms Scale (UGHS; Murray-Boyle et al., 2021) were combined for analysis to form the Gambling Harms Scale (GHS). While the 10-item SGHS is a reliable and validated measure of gambling-related harm, it includes some items that arguably describe minor harms. The 10-item UGHS was therefore included to add further probes that are incontrovertibly harmful and serious (e.g. 'late payment on bills'). Respondents were asked if, over the last 12 months, they had experienced each of the 20 harms as a result of their pokies gambling (no/yes), with higher scores indicating more harms. Cronbach's alpha was .94.

Risk Factors for Gambling Harm Several known risk factors for experiencing significant gambling harm (Browne et al., 2019) were measured: frequency of pokies gambling, frequency of playing pokies alone, whether any adults in their household had a gambling problem when the respondent was growing up, the Gambling Urge Scale (Raylu & Oei, 2004; Cronbach's alpha was .96.), Gambling Fallacies Measure (2003; Cronbach's alpha was .70.), a single item to rate the importance of religion or spirituality in their life (Likert: 1 not at all to 5 extremely important) and the Barratt Impulsiveness Scale—Brief (Steinberg et al., 2013; Cronbach's alpha was .73).

Demographics Participants reported their age and other demographics (Table 1).

Participant Characteristics

The sample comprised 59.7% males and 40.3% females (Table 1). Age ranged from 18 to 87 years ($m = 41.1$ years). Table 1 details other demographic characteristics.

The mean number of harms reported from the GHS was 5.60 ($SD = 6.01$) from a possible range of 1–20. The mean score on the Gambling Fallacies Measure was 4.82 ($SD = 2.46$) from a possible range of 0–10, with higher scores indicating greater resistance to gambling fallacies. The mean Gambling Urge Scale score was 19.40 ($SD = 10.61$) from a possible range of 6–42, with higher scores indicating higher urges. Around half the participants (47.5%) rated religion or spirituality as moderately to extremely important in their lives. The Barratt Impulsiveness Scale mean score was 17.29 ($SD = 4.08$) from a possible range of 8–32, with higher scores indicating higher impulsivity.

Analysis

Individuals experiencing gambling-related harm may employ SRSs to improve upon their outcomes. This self-selection in using SRSs complicates a simple analysis to identify which SRSs may be effective in reducing harm. Some of the worst affected gamblers are likely to employ some good strategies that are nevertheless not 100% effective. To address this confounding issue, the analyses employed a propensity matching approach to create two matched groups of persons that are either harmed or not harmed by gambling. Critically, after selection and propensity weighting, both groups have an equal chance (or propensity) for being harmed by gambling based on the known risk factors measured (Browne et al., 2019). SRSs that are more frequently used by the unharmed group can thus more confidently be attributed to the use of such strategies, since the propensity matching has

Table 1 Study 1: Participant characteristics

Variable	<i>n</i>	%
<i>Gender</i>		
Male	1,213	59.7
Female	818	40.3
Other	1	0.0
<i>Country of birth</i>		
Australia	1,745	85.9
Other	287	14.1
<i>Main language spoken at home</i>		
English	1,937	95.3
A language other than English	95	4.7
<i>Aboriginal or Torres Strait Islander origin</i>		
Not, not Aboriginal or Torres Strait Islander	1,707	84.0
Yes, Aboriginal	187	9.2
Yes, Torres Strait Islander	39	1.9
Yes, both Aboriginal and Torres Strait Islander	60	3.0
Prefer not to say	39	1.9
<i>Marital status</i>		
Married	936	46.1
Living with partner/de facto	270	13.3
Single/never married	650	32.0
Separated or divorced	137	6.7
Widowed	39	1.9
<i>Living arrangements</i>		
Live alone	459	22.6
Couple (no dependents)	446	21.9
Couple with at least one dependent child	516	25.4
Couple living with independent child(ren)	228	11.2
Single parent living with at least one dependent child	94	4.6
Single parent living with independent child(ren)	41	2.0
Share house with other adults (not your parents or children)	98	4.8
Live with parents	139	6.8
Other	11	0.5
<i>Highest level of education</i>		
Year 10 or below	170	8.4
Year 12 or equivalent	285	14.0
A trade, technical certificate or diploma	414	20.4
A university or college degree	782	38.5
Postgraduate qualifications	381	18.8
<i>Employment</i>		
Work full-time	1,119	55.1
Work part-time or casual	286	14.1
Self-employed	160	7.9
Unemployed and looking for work	73	3.6
Full-time student	46	2.3

Table 1 (continued)

Variable	<i>n</i>	%
Full-time home duties	67	3.3
Retired	222	10.9
Disability pension	45	2.2
Other	14	0.7
<i>Annual household pre-tax income</i>		
Negative income	11	0.5
Nil income	18	0.9
\$1 to \$7,799	18	0.9
\$7,800 to \$15,599	20	1.0
\$15,600 to \$20,799	39	1.9
\$20,800 to \$25,999	75	3.7
\$26,000 to \$33,799	108	5.3
\$33,800 to \$41,599	112	5.5
\$41,600 to \$51,999	127	6.3
\$52,000 to \$64,999	130	6.4
\$65,000 to \$77,999	149	7.3
\$78,000 to \$90,999	229	11.3
\$91,000 to \$103,999	222	10.9
\$104,000 to \$155,999	456	22.4
\$156,000 to \$259,999	235	11.6
\$260,000 or more	83	4.1
<i>PGSI categories</i>		
Non-problem gambler	510	25.1
Low-risk gambler	318	15.6
Moderate-risk gambler	385	18.9
Problem gambler	819	40.3
<i>Frequency of EGM gambling</i>		
4 or more times a week	163	8.1
2–3 times a week	433	21.3
Once a week	534	26.3
2–3 times a month	459	22.6
Once a month	443	21.8
<i>When you play the pokies, how often do you play them alone?</i>		
Never	326	16.0
Sometimes	895	44.0
Often	410	20.2
Almost always	401	19.7
<i>When you were a child growing up, did any of the adults in your household have a gambling problem?</i>		
No gambling problem	1,335	65.7
Mild gambling problem	569	28.0
Severe gambling problem	128	6.3

controlled (by degrees) for the issue that some people ‘at risk’ are more likely to use a variety of SRSs out of need. This approach provides results that are more accurate and usable for people, such as clinical practitioners, who are looking for what SRSs to recommend.

As a first step, participants were matched one-to-one across both groups according to the predicted probabilities for their risk for being harmed by gambling. People who could not be matched were discarded ($n = 148$, 7.3%), as is common in propensity matching (Leite, 2016). After this step, however, the unharmed group still had a lower overall propensity for being harmed by gambling relative to the harmed group. Discarding unmatched cases cannot eliminate all risk discrepancies between the two groups.

In the second step, cases were weighted inversely with respect to their propensity for risk of gambling harm, in the case of harmed gamblers $1/p$ and for unharmed gamblers $1/(1-p)$. For example, an unharmed gambler whose behaviour and traits led us to expect them to be at relatively high risk of gambling harm was up-weighted. Similarly, a harmed gambler whose behaviour and traits indicated a relatively low-risk was down-weighted. This weighting acts to make the two groups equivalent in terms of known risk factors, removing the effect of these confounding variables, and makes them more directly comparable when evaluating the effects of SRSs. In the third step, after matching and weighting, we evaluated SRSs by a simple comparison of their prevalence among (weighted) harmed and unharmed gamblers. In short, SRSs that are used more frequently by the unharmed group, inclusive of weighting, are inferred to be effective at preventing gambling-related harm.

The fourth step assessed whether the use of the most efficacious SRSs differed by gambler characteristics. Non-parametric tests examined the relationships between SRS scores (total number of endorsed SRSs) and the predictors. The relationship between gender and SRS scores was examined using a Mann-Whitney U test. Spearman’s correlation examined age and SRS score. Kruskal-Wallis tests examined the relationship between SRS scores and EGM gambling frequency.

Results

Use of SRSs

Table 2 shows the use of the 45 SRSs. The most used SRSs were ‘I usually play low denomination pokies’ (73.1%), ‘When I have a large win on the pokies, it is time for me to quit’ (72.6%), and ‘I keep a household budget’ (70.9%).

Identification of the most efficacious SRSs

We first constructed a propensity model of the likelihood of participants experiencing harm. Because the PSM framework requires two defined groups, we implemented a 0–2 versus 3+ categorisation based on the Gambling Harm Scale (GHS). Browne et al. (2020) found that scores 1–2 showed a small but significant decrement to health utility, whereas scores 3+ showed both a significant difference and a clinically meaningful effect size. Therefore, 0–2 was used to indicate lesser harm vs 3+ indicating greater harm.

Table 3 summarises the risk factors based on a logistic regression. All effects were significantly associated with the probability of being significantly harmed by EGM play.

Case matching based on the predicted probabilities was then applied to the 2032 cases, across the not-harmed (technically less harmed) and more harmed groups, leading to 148 unmatched cases, and 942 matched cases in each group. Weighting was then applied, as

Table 2 Study 1: Proportion of the sample who endorsed each SRS

Please indicate whether you disagree or agree with each of the following statements in relation to your gambling:	Proportion of sample who agree	
	<i>n</i>	%
I usually play low denomination pokies	1,485	73.1
When I have a large win on the pokies, it is time for me to quit	1,476	72.6
I keep a household budget	1,441	70.9
If I'm not having fun playing the pokies, I stop	1,430	70.4
When I play the pokies, I always set aside a fixed amount to spend	1,405	69.1
If I'm losing after an hour (or 1/2 h, 2 h, etc.) of playing the pokies, my rule is to quit	1,333	65.6
When I feel myself getting too emotional playing the pokies, I take a break	1,329	65.4
My leisure time is busy with other hobbies, social activities and/or sports	1,324	65.2
I restrict myself to playing the pokies only on 1 or 2 days a week, or less often	1,309	64.4
As a rule, I don't go and play the pokies just to avoid being bored	1,264	62.2
I usually cash out pokie winnings and do not use them later in the session	1,254	61.7
I only use pokies winnings for fun activities or purchases	1,243	61.2
I have a dedicated budget to spend on the pokies	1,238	60.9
When I play the pokies, I always bet a fixed amount per spin	1,187	58.4
I don't play the pokies just because my friends are gambling	1,150	56.6
I make sure I take regular breaks (at 30 min, 1 h, etc.) when playing the pokies	1,095	53.9
Before I play the pokies, I make a point to think about how I will feel if I lose the money	1,091	53.7
I play free games to help limit my pokie playing	1,091	53.7
Before I play the pokies, I make a point to think about what else I could do with the money	1,086	53.4
I don't play the pokies when I have consumed alcohol or drugs	1,063	52.3
I don't use pokie winnings to pay bills	1,061	52.2
I keep a record of how much I spend on the pokies	1,046	51.5
I don't play the pokies with friends who like higher stakes than I do	1,018	50.1
I usually schedule other activities after playing pokies to limit session times	1,018	50.1
I deliberately ignore or don't read pokies advertisements or promotions	1,005	49.5
When I play the pokies, I only gamble on my favourite machine	989	48.7
If I'm feeling depressed or upset, I don't play the pokies	980	48.2
I make a point of thinking about my family when I play the pokies	971	47.8
Before I play the pokies, I make a point to think about how long it took me to save the money	956	47.0
I always read the information screen on the pokies before I play	925	45.5
I have a rule that I only play the pokies for an hour (or 1/2 h) at a time	921	45.3
I repurchase goods and/or prepay bills to reduce spare cash	908	44.7
I have set up a spending limit on my membership or loyalty cards at my pokie venue(s)	903	44.4
I restrict myself to playing pokies only in the evenings	872	42.9
I always leave my bank cards at home when I play the pokies at venues	870	42.8
I look at the odds of winning on the pokies before I play	847	41.7
I often talk about the pokies with my friends and/or family	815	40.1
I won't go out with friends if I think that they will encourage me to play the pokies	795	39.1
I play the pokies to make money/supplement my income	778	38.3
I have a rule that I don't go and play the pokies alone	766	37.7
I research systems or strategies for success on the pokies	763	37.5
I usually give my cash or cards to family or friends to limit my access	760	37.4

Table 2 (continued)

Please indicate whether you disagree or agree with each of the following statements in relation to your gambling:	Proportion of sample who agree	
	<i>n</i>	%
I usually give pokie winnings to someone else, such as my partner or friend while gambling	759	37.4
I have lowered my limit for ATM cash withdrawals	751	37.0
I have used cash advances on my credit card to play the pokies	679	33.4

Table 3 Study 1: Risk factors for experiencing significant gambling harms

	<i>B</i>	SE (<i>B</i>)
<i>Risk factor</i>		
Adults in the household with gambling problems	.72*	.10
Frequency of EGM play	.23*	.05
Playing EGMs alone	.31*	.06
Gambling urges	.06*	.01
Gambling fallacies	.11*	.03
Impulsivity	.20*	.02
Spirituality	.20*	.05
<i>Constant</i>	-7.6*	.47
Null deviance: 2815.9, residual deviance: 1913.1, * $p < .01$		
Unstandardized coefficients		

detailed earlier. Lastly, a weighted average frequency in the use of each SRS was calculated in each group, and the difference between use by harmed and unharmed gamblers was calculated. This difference (larger means a stronger association with avoiding harm) was then used to rank and evaluate the SRSs. Table 4 summarises all 17 SRSs that were associated with decreased harm, after matching and weighting. The differential P scores describe the difference in the probability that an SRS would be employed by an unharmed gambler, as opposed to a harmed gambler. This heuristic can be used to capture the association between SRS use and the avoidance of harm.

Use of the Most Efficacious SRSs and By Personal Characteristics

This analysis examined use of the most efficacious SRSs and by age, gender, PGSI and EGM frequency. Participants ranged from using all 17 SRSs to none, with a mean score of 10.65 ($SD = 4.06$). There was no significant difference between the number of SRSs used between males ($m = 10.60$, $SD = 4.12$) and females ($m = 10.71$, $SD = 3.96$). There was a significant but negligible-strength positive relationship between age and number of SRSs used ($r_S = .073$, $p = .001$), with older participants tending to use more SRSs. There were no significant differences in the mean SRS scores across EGM gambling frequency. The number of identified SRSs used was associated with a significantly lower likelihood of being in the moderate-risk or problem gambling categories of the PGSI, $r_S = -.18$, $p < 0.01$.

Table 4 Study 1: Propensity model of experiencing significant harms

Self-regulatory strategy	P (use by unharmed)— P (use by harmed)
1. I usually cash out large pokie winnings and do not use them later in the session	0.080365447
2. When I play the pokies, I always set aside a fixed amount to spend	0.064569413
3. I make sure I take regular breaks (at 30 min, 1 h, etc.) when playing the pokies	0.062808615
4. My leisure time is busy with other hobbies, social activities and/or sports	0.058719524
5. I usually play low denomination pokies	0.047357401
6. As a rule, I don't go and play the pokies just to avoid being bored	0.033555601
7. I only use pokies winnings for fun activities or purchases	0.029636513
8. I keep a household budget	0.022212198
9. I don't play the pokies just because my friends are gambling	0.021407019
10. I don't use pokie winnings to pay bills	0.020623388
11. When I have a large win on the pokies, it is time for me to quit	0.016793672
12. If I'm losing after an hour (or 1/2 h, 2 h, etc.) of playing the pokies, my rule is to quit	0.013030408
13. When I feel myself getting too emotional playing the pokies, I take a break	0.012345407
14. I have a rule that I only play the pokies for an hour (or 1/2 h) at a time	0.010869709
15. I have a dedicated budget to spend on the pokies	0.010421583
16. When I play the pokies, I always bet a fixed amount per spin	0.008597673
17. If I'm not having fun playing the pokies, I stop	0.002973718

Study 2: Randomised Controlled Trial

Methods

Study 2 was approved by Central Queensland University Human Research Ethics Committee (#22959).

Recruitment

Online panel aggregator, Qualtrics, recruited participants via online convenience panels to complete three surveys, each 1 month apart, in June to August 2021. As with study 1, the focus was on regular EGM players who lived in NSW. Inclusion criteria were aged 18 years or older, playing EGMs in the last 4 weeks, living in NSW and having an interest in better controlling how much they spend on EGMs. Of the 1238 participants who completed the wave 1 survey, 103 were excluded based on data quality checks as well as 47 who did not opt-in to receive SMS messages as part of the experimental design. Data quality checks detected four duplicate responses at wave 2 and seven in wave 3 and these duplicates were removed. Sample sizes after exclusions totalled 1088 (wave 1), 756 (wave 2) and 725 (wave 3).

Sample Characteristics

The sample was reasonably balanced by gender, had a mean age of 32.7 years (range 18–83), and most respondents were married/de facto, were university-educated and worked full-time (Table 5).

Procedure

For parsimony, the 17 most efficacious SRSs identified in study 1 were reduced to 13 SRSs for the RCT by combining similar items. Table 6 lists the 13 SRSs, their codes and number of participants and data points per SRS. In wave 1, approximately two-thirds of respondents were randomly allocated to one of the 13 SRSs and asked: ‘For the NEXT 4 WEEKS, please try to consistently use this practice when you play the pokies’. About one-third of participants were allocated to the control group. Randomisation to the 14 groups was

Table 5 Study 2: Demographic characteristics at Wave 1

Variable	Test N (%)	Control N (%)	Variable	Test N (%)	Control N (%)
Gender			Main language at home		
<i>Male</i>	359 (48.9)	177 (49.9)	<i>English</i>	623 (84.99)	296 (83.38)
<i>Female</i>	374 (51.0)	178 (50.1)	<i>Other</i>	110 (15.01)	59 (16.62)
Marital status			Work status		
<i>Single/ never married</i>	219 (29.88)	110 (30.99)	<i>Work full-time</i>	396 (54.02)	181 (50.99)
<i>De facto</i>	175 (23.87)	85 (23.94)	<i>Work part-time/ casual</i>	176 (24.01)	93 (26.2)
<i>Married</i>	298 (40.65)	146 (41.13)	<i>Self-employed</i>	31 (4.23)	14 (3.94)
<i>Divorced or separated</i>	40 (5.46)	12 (3.38)	<i>Unemployed & looking</i>	36 (4.91)	17 (4.79)
<i>Widowed</i>	1 (0.14)	2 (0.56)	<i>Full-time student</i>	42 (5.73)	10 (2.82)
Household composition			<i>Full-time home duties</i>	27 (3.68)	19 (5.35)
<i>Single person</i>	135 (18.42)	69 (19.44)	<i>Retired</i>	16 (2.18)	13 (3.66)
<i>One parent with children</i>	48 (6.55)	24 (6.76)	<i>Sick or disability pension</i>	4 (0.55)	5 (1.41)
<i>Couple with children</i>	285 (38.88)	128 (36.06)	<i>Other</i>	5 (0.68)	3 (0.85)
<i>Couple no children</i>	166 (22.65)	97 (27.32)	Personal income		
<i>Group household</i>	83 (11.32)	34 (9.58)	<i>\$0 to \$9,999</i>	29 (3.96)	10 (2.82)
<i>Other</i>	16 (2.18)	3 (0.85)	<i>\$10,000 to \$19,999</i>	32 (4.37)	20 (5.63)
Education			<i>\$20,000 to \$29,999</i>	53 (7.23)	29 (8.17)
<i>Not completed primary</i>	3 (0.41)	3 (0.85)	<i>\$30,000 to \$39,999</i>	60 (8.19)	30 (8.45)
<i>Completed primary</i>	8 (1.09)	3 (0.85)	<i>\$40,000 to \$49,999</i>	91 (12.41)	44 (12.39)
<i>Year 10</i>	50 (6.82)	27 (7.61)	<i>\$50,000 to \$59,999</i>	94 (12.82)	52 (14.65)
<i>Year 12</i>	117 (15.96)	54 (15.21)	<i>\$60,000 to \$69,999</i>	62 (8.46)	27 (7.61)
<i>Trade or tech qual.</i>	143 (19.51)	81 (22.82)	<i>\$70,000 to \$79,999</i>	49 (6.68)	37 (10.42)
<i>Uni or college degree</i>	301 (41.06)	127 (35.77)	<i>\$80,000 to \$89,999</i>	44 (6)	18 (5.07)
<i>Postgrad qualification</i>	111 (15.14)	60 (16.9)	<i>\$90,000 to \$99,999</i>	30 (4.09)	16 (4.51)
Aboriginal or Torres Strait Islander status			<i>\$100,000 to \$109,999</i>	36 (4.91)	14 (3.94)
<i>Non-ATSI</i>	686 (93.59)	329 (92.68)	<i>\$110,000 to \$119,999</i>	17 (2.32)	8 (2.25)
<i>Aboriginal</i>	36 (4.91)	20 (5.63)	<i>\$120,000 to \$129,999</i>	20 (2.73)	12 (3.38)
<i>Torres Strait Islander</i>	7 (0.95)	5 (1.41)	<i>\$130,000 to \$139,999</i>	14 (1.91)	3 (0.85)
<i>Both</i>	4 (0.55)	1 (0.28)	<i>\$140,000 to \$149,999</i>	20 (2.73)	7 (1.97)
Country of birth			<i>\$150,000 to \$159,999</i>	17 (2.32)	8 (2.25)
<i>Australia</i>	538 (73.4)	253 (71.27)	<i>\$160,000 or more</i>	28 (3.82)	7 (1.97)
<i>Other</i>	195 (26.6)	102 (28.73)	<i>Don't know</i>	37 (5.05)	13 (3.66)

Age recorded as continuous score. Mean = 32.7, SD = 11.52, median = 30, range 18–83

stratified by gender and age (18–34 and 35+ years) and reported weekly hours of EGM play (< 16 and 16+). At the end of each survey, the test group was reminded to use their allocated SRS during the next 4 weeks, while the control group was simply reminded to ‘gamble responsibly’. Respondents were also sent an SMS with the same message between waves.

Measures

After screening questions based on the inclusion criteria, the following measures were administered.

Demographics (wave 1): age, gender and the characteristics in Table 5.

EGM playing behaviour in the last 4 weeks (waves 1–3): number of hours spent playing EGMs (open-ended text box) and EGM expenditure (defined as losses; open-ended text box).

Short Gambling Harms Screen (waves 1–3): The 10-item SGHS (Browne et al., 2018) was modified to ask about harms experienced within the last 4 weeks as a result of the respondent’s EGM play (no/yes). Cronbach’s alpha was .81 (Wave 1), .87 (Wave 2) and .95 (Wave 3).

Use of assigned SRS (waves 1–3, test group only): How often they used their assigned SRS during the last 4 weeks (never, sometimes, most of the time, always)

Analysis

The analysis involved three main steps. A nested experimental design where multiple observations were nested within participants was employed, with the primary level being a comparison of exposure to each of the tested SRS messages ($N = 733$, codes 1–13) with a

Table 6 Study 2: SRSs, codes, and number of participants and observations per SRS

Code	Self-regulatory strategy (SRS)	N_{pers}	N_{obs}
0	Gamble responsibly*	355	695
1	Cash out pokie winnings and do not use them later in the session	54	134
2	When you play the pokies, always set aside a fixed amount to spend	55	142
3	Make sure you take regular breaks every 30 min when you are playing the pokies	55	122
4	Make sure your leisure time is busy with other hobbies, social activities and/or sports	58	135
5	Only play low denomination pokies	56	134
6	Don’t go and play the pokies just to avoid being bored	59	130
7	Only use pokies winnings for fun activities or purchases, and not to pay bills	59	137
8	Keep a household budget	56	124
9	Don’t play the pokies just because your friends are gambling	55	134
10	If you’re losing after 30 min of playing the pokies, quit	54	123
11	If you feel yourself getting too emotional when playing the pokies, take a break	60	136
12	When you play the pokies, always bet a fixed amount per spin	56	123
13	If you’re not having fun playing the pokies, stop	56	141

*Control condition

control message, ‘gamble responsibly’ ($N = 355$, code 0). This first analysis evaluated the effects of the assignment of any treatment condition vs the control condition.

Second, comparisons between individual SRSs were conducted to see which were potentially most highly associated with better gambling outcomes. This evaluated the effects of assignment of the individual SRSs vs the control condition.

Third, data were also collected on the frequency with which participants used their allocated SRS. This allowed a secondary repeated measures observational analysis to evaluate the effects of frequency of SRS utilisation on the outcome variables. Our assumption was that actual use of the SRS, rather than simply being assigned to use the SRS, should be associated with better gambling outcomes.

Three key outcomes were employed:

1. *EGM Spend*: spend on EGMs during the prior period. Transformed using the formula $\log(x + 1)$ to stabilise error variance
2. *EGM Time*: number of hours spent playing EGMs during the prior period. Transformed using the formula $\log(x + 1)$ to stabilise error variance
3. *SGHS*: scores on the SGHS, untransformed

Time and spend on gambling are directly implicated in gambling harm and gambling problems (Neal et al., 2005). The SGHS is a direct measure of harmful outcomes that SRSs are intended to prevent (Browne et al., 2018).

The repeated measures design was handled using robust linear mixed effects (RLME) modelling, using the *robustlmm* package in the R statistical programming environment. Since each participant received the same SRS for the duration of the experiment, the data structure can be understood as hierarchical, with multiple observations nested within participants. That is, the design was repeated measures on the same outcomes for each participant. We considered models in which SRS was treated either as a random factor within the treatment condition (i.e. the SRS was considered representative of a large number of SRSs that might have been included in the study, but the set was not comprehensive) or as a fixed effect with 13 levels (i.e. the set of SRSs tested was deemed to be a complete set of possible strategies that could be used). For random effects included in the models below, variances, rather than standard deviations, are reported.

Results

Effects of the Assignment of Any Treatment Condition vs the Control Condition

Table 7 summarises the analyses for the broadscale treatment effect: whether allocation to the treatment conditions (any of codes 1–13) was associated with a differential change in gambling outcomes over time in comparison to the control condition (code 0). There was no improvement over time in any outcome for people assigned to an SRS message condition. This conclusion was manifest in no significant interactions between the variables time (i.e. T2 vs. T1 and T3 vs. T1, respectively) and test (i.e., SRS messages vs. control).

Moreover, model comparisons between the base model (a), including only main effects, and the interaction model (b) that included an additional interaction effect were not significant in each case. This indicates that, in aggregate, allocation to one of the SRS conditions did not result in a detectable change in gambling outcomes during the study period relative to the control condition.

Table 7 Study 2: Summary of RLME models testing for an interaction between experimental condition (test versus control) and time, with a random effect for subject nested within SRS

<i>Fixed effects</i>	EGM Spend		EGM Time		SGHS	
	(a)	(b)	(a)	(b)	(a)	(b)
<i>Main effects</i>						
T1 (Base)	-	-	-	-	-	-
T2	- 0.870** (0.078)	- 0.997** (0.235)	- 0.536** (0.037)	- 0.518** (0.112)	- 1.213** (0.098)	- 1.106** (0.294)
T3	- 2.002** (0.080)	- 2.382** (0.238)	- 0.821** (0.038)	- 0.831** (0.114)	- 1.963** (0.100)	- 2.236** (0.299)
Group (Control)	-	-	-	-	-	-
Group (Test)	- 0.048 (0.103)	0.054 (0.128)	0.013 (0.055)	0.011 (0.066)	0.173 (0.166)	0.204 (0.190)
<i>Interactions</i>						
T1 x Test	-	-	-	-	-	-
T2 x Test	0.095 (0.166)	0.095 (0.166)	- 0.014 (0.079)	- 0.014 (0.079)	- 0.080 (0.207)	- 0.080 (0.207)
T3 x Test	0.285 (0.169)	0.285 (0.169)	0.008 (0.081)	0.008 (0.081)	0.205 (0.212)	0.205 (0.212)
Constant	4.185** (0.149)	4.320** (0.181)	1.783** (0.079)	1.781** (0.093)	4.443** (0.237)	4.483** (0.267)
<i>Random effects</i>						
Subject SRS	1.165	1.165	0.672	0.622	2.164	2.164
Residual	1.609	1.609	0.764	0.764	1.987	1.987

p* < 0.05; *p* < 0.01

Effects of Assignment of the Individual SRSs vs the Control Condition

The above analysis was repeated using a 14-level factor ‘SRS’ (codes 0–13) in place of the 2-level factor ‘group’ (Table 8). These analyses included a random effect for participants only. An analysis of deviance test providing an omnibus comparison of the interaction model with the main-effects only model found only a marginally significant difference for EGM spend, $\chi^2(26) = 39.03, p = .048$. There were no significant *time* \times *SRS* interactions for the dependent variables of EGM Time or SGHS.

Given the significant omnibus test for EGM spend, we considered interpretation of the fixed effects for EGM spend. Inspection of the beta coefficients showed significant decreases in EGM spend for assignment to the following SRSs: (1) T3xSRS2 ($B = -.939, p = .009$) ‘When you play the pokies, always set aside a fixed amount to spend’; (2) T2xSRS4 ($B = -.822, p = .025$), T3xSRS4 ($B = -.799, p = .034$) ‘Make sure your leisure time is busy with other hobbies, social activities and/or sports’ and (3) T3xSRS6 ($B = -1.170, p = .002$) ‘Don’t go and play the pokies just to avoid being bored’. Unlike the omnibus chi-square statistic quoted above, these *p*-values associated with individual beta coefficients do not take into account the multiple comparisons being made within the single regression model.

Effects of Frequency of SRS Utilisation

The above analyses are predicated entirely on assignment of participants, at random, to experimental conditions. However, not all participants adhered to the requested protocol of implementing their assigned SRS during the RCT. Of the 1715 observations in the test condition, 390 reported never (1) using the SRS during that period, 695 sometimes (2), 381 most of the time (3) and 249 always (4). The dataset was therefore analysed as repeated measures relating paired observations of frequency of SRS utilisation and each gambling outcome, rather than an experimental manipulation alone. In this scheme, we compared the simple effect of frequency of SRS use, with the joint effect of which SRS was allocated and the frequency with which that SRS was employed. Importantly, people’s use of SRS was still related to their assigned experimental condition, but the present analysis allowed that people might differentially use the SRSs to which they were assigned. This allowance can be considered as ‘treatment adherence’.

These analyses (Table 9) therefore examined the joint effects of treatment assignment and treatment adherence. Since treatment adherence (i.e. whether people used the SRS) is not an experimental effect, these results are correlational in nature. Results that are highly significant ($p < .01$) hold even after considering that multiple tests were performed. This analysis is valuable since it stands to reason that SRSs ‘work’ because people employ them rather than just ‘think’ about them.

Comparing (a)/(b) models in Table 9, there was a significant improvement in fit for EGM spend, $\chi^2(25) = 50.211, p = .002$, and the SGHS, $\chi^2(25) = 52.741, p = .001$. There was no significant improvement for EGM time, $\chi^2(25) = 32.194, p = .1525$. Detailed evaluation of significant beta coefficients for these two outcomes can be made with respect to Table 9. SRS4 ‘Make sure your leisure time is busy with other hobbies, social activities and/or sports’ stands out as having a significant effect on EGM spend and the SGHS, at the .01 threshold for both main effects of SRS and frequency \times SRS interactions. Thus,

Table 8 Study 2: Models evaluating the effects of assignment of the individual SRSs vs the control condition

	<i>Dependent variables</i>					
	EGM Spend		EGM Time		SGHS	
	(1)	(2)	(3)	(4)	(5)	(6)
T2 (Base: T1)	– 0.869*** (0.078)	– 0.806*** (0.135)	– 0.535*** (0.037)	– 0.545*** (0.064)	– 1.210*** (0.098)	– 1.266*** (0.169)
T3 (Base: T1)	– 2.002*** (0.080)	– 1.811*** (0.138)	– 0.820*** (0.038)	– 0.815*** (0.066)	– 1.960*** (0.100)	– 1.826*** (0.173)
SRS1	0.271 (0.231)	0.257 (0.289)	0.055 (0.124)	0.147 (0.149)	0.409 (0.372)	0.239 (0.429)
SRS2	– 0.165 (0.226)	0.122 (0.287)	– 0.102 (0.122)	0.028 (0.148)	– 0.292 (0.366)	– 0.185 (0.426)
SRS3	– 0.033 (0.236)	0.053 (0.287)	0.079 (0.126)	0.104 (0.148)	0.759** (0.376)	0.869** (0.426)
SRS4	– 0.166 (0.227)	0.269 (0.281)	0.028 (0.121)	0.111 (0.144)	0.165 (0.363)	0.510 (0.416)
SRS5	0.058 (0.229)	0.138 (0.285)	0.005 (0.123)	– 0.100 (0.147)	– 0.154 (0.368)	– 0.219 (0.423)
SRS6	– 0.002 (0.229)	0.432 (0.279)	– 0.085 (0.122)	0.014 (0.143)	0.272 (0.364)	0.093 (0.413)
SRS7	– 0.274 (0.226)	– 0.297 (0.279)	0.115 (0.121)	0.151 (0.143)	– 0.276 (0.362)	– 0.246 (0.413)
SRS8	0.267 (0.234)	0.110 (0.285)	0.089 (0.125)	0.035 (0.147)	0.790** (0.373)	0.799* (0.423)
SRS9	– 0.183 (0.230)	0.037 (0.287)	0.019 (0.123)	0.041 (0.148)	0.185 (0.370)	0.142 (0.426)
SRS10	– 0.106 (0.235)	– 0.082 (0.289)	0.006 (0.126)	0.026 (0.149)	0.021 (0.376)	0.313 (0.429)
SRS11	– 0.385* (0.225)	– 0.581** (0.277)	– 0.088 (0.121)	– 0.258* (0.142)	– 0.203 (0.360)	– 0.326 (0.410)
SRS12	0.173 (0.234)	0.283 (0.285)	0.079 (0.125)	– 0.032 (0.147)	0.243 (0.373)	0.174 (0.423)
SRS13	– 0.025 (0.226)	– 0.001 (0.285)	– 0.015 (0.122)	– 0.107 (0.147)	0.420 (0.365)	0.549 (0.423)
T2 x SRS1		0.291 (0.369)		– 0.084 (0.176)		0.077 (0.462)
T3 x SRS1		– 0.253 (0.370)		– 0.249 (0.177)		0.539 (0.464)
T2 x SRS2		– 0.088 (0.354)		– 0.074 (0.169)		0.113 (0.443)
T3 x SRS2		– 0.939*** (0.363)		– 0.384** (0.173)		– 0.517 (0.454)
T2 x SRS3		– 0.061 (0.391)		0.125 (0.187)		– 0.069 (0.494)
T3 x SRS3		– 0.262		– 0.225		– 0.394

Table 8 (continued)

	<i>Dependent variables</i>					
	EGM Spend		EGM Time		SGHS	
	(1)	(2)	(3)	(4)	(5)	(6)
		(0.389)		(0.186)		(0.490)
T2 x SRS4		- 0.822**		- 0.158		- 0.538
		(0.365)		(0.174)		(0.458)
T3 x SRS4		- 0.799**		- 0.160		- 0.810*
		(0.375)		(0.179)		(0.472)
T2 x SRS5		- 0.229		0.039		0.269
		(0.370)		(0.177)		(0.464)
T3 x SRS5		- 0.066		0.353**		- 0.030
		(0.371)		(0.177)		(0.466)
T2 x SRS6		- 0.559		- 0.150		0.508
		(0.377)		(0.181)		(0.476)
T3 x SRS6		- 1.170***		- 0.261		0.242
		(0.382)		(0.183)		(0.481)
T2 x SRS7		0.125		- 0.059		0.011
		(0.368)		(0.176)		(0.463)
T3 x SRS7		- 0.028		- 0.081		- 0.137
		(0.369)		(0.177)		(0.465)
T2 x SRS8		0.249		0.123		0.620
		(0.383)		(0.184)		(0.484)
T3 x SRS8		0.415		0.099		- 0.702
		(0.392)		(0.188)		(0.495)
T2 x SRS9		- 0.105		- 0.069		0.060
		(0.370)		(0.177)		(0.465)
T3 x SRS9		- 0.692*		- 0.014		0.087
		(0.369)		(0.176)		(0.463)
T2 x SRS10		- 0.249		- 0.083		- 0.542
		(0.384)		(0.184)		(0.483)
T3 x SRS10		0.177		0.004		- 0.629
		(0.389)		(0.186)		(0.490)
T2 x SRS11		0.691*		0.300*		0.417
		(0.364)		(0.174)		(0.458)
T3 x SRS11		0.051		0.378**		0.068
		(0.377)		(0.181)		(0.476)
T2 x SRS12		- 0.364		0.234		0.028
		(0.394)		(0.189)		(0.497)
T3 x SRS12		- 0.079		0.219		0.239
		(0.384)		(0.184)		(0.484)
T2 x SRS13		- 0.156		0.088		0.108
		(0.354)		(0.169)		(0.443)
T3 x SRS13		0.086		0.253		- 0.624
		(0.368)		(0.176)		(0.461)
Constant	4.280***	4.212***	1.757***	1.759***	4.095***	4.076***

Table 8 (continued)

	<i>Dependent variables</i>					
	EGM Spend		EGM Time		SGHS	
	(1)	(2)	(3)	(4)	(5)	(6)
	(0.092)	(0.105)	(0.048)	(0.054)	(0.143)	(0.156)
Observations	2569	2569	2569	2569	2569	2569
Log Likelihood	- 5298.884	- 5283.212	- 3521.917	- 3528.224	- 6109.569	- 6096.638
Akaike Inf. Crit.	10,633.770	10,654.420	7079.834	7144.448	12,255.140	12,281.280
Bayesian Inf. Crit.	10,739.090	10,911.880	7185.157	7401.904	12,360.460	12,538.730

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

the frequency with which people used this SRS was related to better outcomes on spend and harms experienced. SRS3, 'Make sure you take regular breaks every 30 minutes when you are playing the pokies' also showed consistent main effects for EGM spend, as well as an interaction for EGM spend. Thus, frequently adhering to regular breaks was associated with lower spending. Lastly, SRS8 'Keep a household budget' had a significant main effect and frequency interaction effect for the SGHS. People who more frequently kept a budget had lower gambling-related harm.

Discussion

Study 1 identified a group of SRSs that best predicted less harmful gambling amongst 2032 frequent EGM players. The individual use of 17 SRSs and the total number of these SRSs used were both associated with decreased EGM-related harm. On average, participants used 10.7 of the 17 effective SRSs. There was no significant difference in their use by gender or EGM gambling frequency, and only an extremely weak association with age.

Study 2 tested the efficacy of 13 protective SRSs identified from study 1 when delivered as a brief intervention to EGM players wanting to reduce harmful play. In the first wave, the 1088 respondents were randomly allocated to either one of the 13 SRS test conditions or the control condition ('gamble responsibly'). Outcome measures comprised EGM expenditure, time spent playing EGMs and EGM-related harm. Assignment to any SRS treatment condition (in aggregate) did not result in a detectable change in gambling outcomes relative to the control condition. However, significant decreases in EGM spend were observed for *assignment* to the following SRSs: 'When you play the pokies, always set aside a fixed amount to spend' (SRS2), 'Make sure your leisure time is busy with other hobbies, social activities and/or sports' (SPG4), and 'Don't go and play the pokies just to avoid being bored' (SRS6). When evaluating the effects of the frequency of *utilising* the assigned SRS, three SRSs had significant effects on one or more gambling outcomes. Increased frequency of using SRS4, 'Make sure your leisure time is busy with other hobbies, social activities and/or sports', resulted in a significant reduction in EGM spend and EGM-related harm. Increased frequency of using SRS3, 'Make sure you take regular breaks every 30 minutes when you are playing the pokies', resulted in a significant reduction in EGM spend. Increased frequency of using SRS8, 'Keep a household budget', resulted in a significant reduction in EGM-related harm. Of additional interest is that the SRSs that resulted in

Table 9 Study 2: Summary of models of the effect of SRS allocation and frequency of use on gambling outcomes

	EGM spend		EGM time		SGHS	
	(a)	(b)	(a)	(b)	(a)	(b)
<i>Fixed effects</i>						
<i>Main effects</i>						
Freq	-0.025 (0.045)	0.181 (0.182)	-0.0001 (0.022)	0.001 (0.088)	-0.115* (0.062)	0.027 (0.232)
SRS0 (Base)		-		-		-
SRS1		0.711 (0.537)		0.114 (0.266)		0.556 (0.727)
SRS2		-0.167 (0.528)		-0.088 (0.261)		0.786 (0.710)
SRS3		1.389** (0.525)		0.456 (0.263)		1.508* (0.726)
SRS4		1.723** (0.577)		0.824** (0.285)		3.088** (0.774)
SRS5		-0.295 (0.557)		-0.385 (0.278)		0.030 (0.765)
SRS6		-0.593 (0.552)		-0.421 (0.276)		0.009 (0.762)
SRS7		-0.263 (0.506)		0.259 (0.252)		0.285 (0.694)
SRS8		0.742 (0.553)		-0.034 (0.275)		2.333** (0.753)
SRS9		0.846 (0.537)		0.161 (0.265)		0.989 (0.721)
SRS10		0.262 (0.542)		0.206 (0.271)		0.518 (0.745)
SRS11		-0.166 (0.493)		-0.190 (0.247)		-1.045 (0.681)
SRS12		-1.214* (0.584)		-0.444 (0.287)		-0.692 (0.779)
SRS13		-0.246 (0.308)		-0.030 (0.158)		0.354 (0.453)
<i>Interactions</i>						
Freq × SRS1		-0.321 (0.276)		-0.034 (0.134)		-0.095 (0.353)
Freq × SRS2		-0.138 (0.248)		-0.018 (0.120)		-0.461 (0.316)
Freq × SRS3		-0.731** (0.268)		-0.163 (0.131)		-0.327 (0.350)
Freq × SRS4		-0.889** (0.276)		-0.332* (0.134)		-1.242** (0.356)
Freq × SRS5		0.044 (0.275)		0.168 (0.134)		-0.096 (0.358)
Freq × SRS6		0.176 (0.274)		0.160 (0.134)		0.136 (0.358)
Freq × SRS7		-0.105 (0.249)		-0.057 (0.121)		-0.232 (0.321)

Table 9 (continued)

	EGM spend		EGM time		SGHS	
	(a)	(b)	(a)	(b)	(a)	(b)
Freq × SRS8		-0.271 (0.272)		0.068 (0.132)		-0.642* (0.351)
Freq × SRS9		-0.585* (0.276)		-0.067 (0.133)		-0.392 (0.351)
Freq × SRS10		-0.240 (0.268)		-0.080 (0.131)		-0.203 (0.347)
Freq × SRS11		-0.163 (0.264)		0.064 (0.129)		0.425 (0.342)
Freq × SRS12		0.491* (0.276)		0.227* (0.134)		0.404 (0.353)
Freq × SRS13		-		-		-
Constant	3.515** (0.097)	3.311** (0.201)	1.401** (0.049)	1.385** (0.099)	3.596** (0.140)	3.220** (0.270)
<i>Random effects</i>						
Subject SRS	1.056		0.404		4.54	
Subject		1.093		0.415		4.54
Residual	3.575	3.508	0.760	0.752	4.88	4.81

For the main effects, the control group is the comparison group, and coefficients are therefore differences between each SRS and the control group. For interactions, the control group was not asked how often they gambled responsibly, so the comparison group for the interaction terms is SRS13

* $p < 0.05$; ** $p < 0.01$

reduced EGM spend and EGM-related harm in study 2 were also strongly negatively associated with gambling harm in study 1.

Overall, the results suggest that not all SRSs that might be promoted to gamblers are likely to lead to beneficial gambling outcomes, but that some SRSs have greater efficacy. This emphasises the importance of research that identifies the optimal set of SRSs that should be promoted to gamblers. This study has provided arguably the strongest evidence to date of the efficacy of certain SRSs for EGM players. However, the findings are subject to limitations. The samples may not be representative of the NSW population of frequent EGM players. The findings are also based on self-report data, which may be subject to recall and social desirability biases. In line with good scientific practice, replication studies are needed to confirm the findings in different samples and jurisdictions and to assess gambling outcomes from SRS-use over the medium and longer term. Nonetheless, the study advances current knowledge about the potential effectiveness of SRSs, since its design overcame several limitations of earlier research.

While further research would be beneficial, using the study's findings to refine the SRSs that are currently promoted to EGM players would improve on current advice. This is because the currently promoted SRSs have very little evidence supporting their efficacy and generally have been selected on an ad hoc basis. Instead, the five SRSs (2, 3, 4, 6 and 8) that resulted in reduced EGM spend and/or EGM-related harm could be helpfully communicated on help service websites, in brochures and signage in gambling venues, on gambling websites and apps and in public education materials. The five efficacious SRSs could also be used as a 'call to action' in responsible gambling messages, since widely used messages have been criticised for being superficial and lacking helpful advice (Hing, Nuske, et al., 2016a; Newall et al., 2022; Sproston et al., 2015). The five SRSs could also provide the basis for a consumer self-assessment tool with automated feedback, to encourage consumers to assess and self-regulate their gambling by using the promoted SRSs. The SRSs might assist treatment providers by identifying actionable strategies to help their clients make behavioural changes to reduce financial impacts and harm from their gambling.

Conclusion

Most harm from gambling is attributable to EGMs (Browne et al., 2023). Consumer protection from this harm is largely based on an informed choice model (Błaszczynski et al., 2004) that relies on players self-regulating their gambling. Strategies to assist this self-regulation are currently widely promoted (Hing, Russell, & Hronis, 2016b) but have very little evidence to support their efficacy. This study has advanced the evidence base to support the use of five SRSs that are empirically associated with reduced EGM spend and/or EGM-related harm.

However, we caution that adherence to these SRSs does not guarantee that a person's gambling will be harm-free. We also acknowledge that these strategies may be perceived as placing increased responsibility on people to self-regulate their gambling. We emphasise that our focus on SRSs in this research is not intended to downplay the role of industry or governments in reducing gambling harm by providing safer gambling products, environments and policies. Instead, it provides people who gamble with harm minimisation advice. In short, effective SRSs are just one ingredient in a broader public health approach needed to reduce gambling harm.

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Declarations

Ethics The study procedures were carried out in accordance with the Declaration of Helsinki. The Institutional Review Board of Central Queensland University approved the study (#22741 and #22959). All subjects were informed about the study, and all provided informed consent.

Conflict of Interest The authors declare no competing interests.

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