DOES SMS IMPROVE GAMBLING SYMPTOMS OVER AND ABOVE E-MENTAL HEALTH? A

FEASIBILITY STUDY

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ABSTRACT

SMS is simple, inexpensive and a convenient method of delivering interventions to people with problem gambling, but there are currently no trials investigating its feasibility or impact. This study explores the feasibility of SMS for people with problem gambling accessing an e-mental health service (i.e., chat, email, forums and brief self-help). The study randomised 198 gamblers to bi-weekly SMS (versus treatment-as-usual [TAU]) over a 12-week period. SMS involved a series of behaviour change techniques as well as a call back for further help. Recruitment and randomization workflow, SMS implementation as well as the impact of text messages on engagement at 12-week follow-up evaluation was also examined. Four out of five gamblers accessing e-mental health were willing to take part and very few withdrew from the study. Furthermore, 10% accessed the new outbound service (text for immediate HELP). There was a significant decrease in gambling symptoms and time and money spent post-treatment, but there was not a significant difference between SMS and TAU (i.e., SMS did not increase the effect of e-mental health). Gamblers accessed an average of 2.5 e-mental health offerings at their initial visit and it could be this mixture of service supports more than met current needs.

Keywords: SMS, text messaging, e-mental health, brief intervention, gambling, internet

DOES SMS IMPROVE GAMBLING OUTCOMES OVER AND ABOVE ACCESS TO OTHER E-MENTAL HEALTH SUPPORTS? A FEASIBILITY STUDY

The way that problem gambling interventions can be delivered has grown exponentially over recent years. This has been due, in part, to a recognition that rates of help-seeking for face-to-face treatment are amongst the lowest of the addictive disorders, at around 8-15% (Productivity Commission, 2010). While face-to-face psychological therapies are effective (Cowlishaw et al., 2012), there is now good evidence that telephone-delivered interventions (Abbott et al., 2012) are also effective in reducing the symptoms of problem gambling. The availability of the internet has further increased the range of treatment options, providing cost-effective treatment delivery across geographical boundaries (Rodda & Lubman, 2014). E-mental health services can include online counselling (i.e., chat, email or video), self-help materials (e.g., self-directed internet interventions), peer support (e.g., online community forums) as well as information (e.g., websites). Gamblers and their family and friends impacted by problem gambling report e-mental health supports interventions that are easy, convenient and discrete to access (Rodda, Lubman, Dowling, Bough, & Jackson, 2013; Rodda, Lubman, Dowling, & McCann, 2013).

Despite these advantages, the growing range of e-mental health options for problem gambling have not yet been subject to the same scrutiny as other interventions. Online counselling (i.e., synchronous chat and asynchronous email) for problem gambling has not yet been extensively evaluated, despite operating for more than 10 years (Rodda & Lubman, 2014; R. T. A. Wood & Griffiths, 2007). Explorative research suggests online counselling immediately reduces distress and increases readiness to change in help-seeking gamblers (Rodda, Dowling, Jackson, & Lubman, 2016), however to date, longer-term outcome research is lacking. Other e-mental health services such as online community forums have also operated for more than 10 years, but the only evaluation is a descriptive study of client characteristics and experiences (R. T. A. Wood & Wood, 2009). There is a growing evidence base indicating self-help

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interventions that are structured and delivered with or without clinician guidance can reduce problem

gambling (Chebli, Blaszczynski, & Gainsbury, 2016). However, the programs that have been subject to

evaluation have been those similar to face-to-face interventions (i.e., more than one session) rather than

brief single session self-help. The lag in evaluation is not unique to problem gambling; multiple

systematic reviews have identified very few studies investigating the effectiveness of chat based

counselling for mental health (Dowling & Rickwood, 2013), email (Ye, Rust, Fry-Johnson, & Strothers,

2010) or peer-to-peer community forums (Ali, Farrer, Gulliver, & Griffiths, 2015).

Over recent years, SMS has been added to the suite of services offered by many gambling helplines

around the world (e.g., Australia, New Zealand and USA). SMS stands for short message service (also

called texting or text messaging) and is a quick and easy way of transferring information to and from an

electronic device (e.g., mobile phone) with a cellular connection. SMS messages can also be delivered to

clients via specialised web-services making this a cost-effective and efficient method of delivering

messages to multiple clients at the same time. Messages can be personalised (e.g., recipients name) and

tailored to the recipient (e.g., preferred frequency and timing of messages). Any cellular telephone

manufactured since the mid 1990s is able to send and receive such messages (up to 160 characters). In

terms of therapeutic contexts, SMS can be one-directional (e.g., an appointment time, a reminder to take

medication, provision of information, supportive messages, self-monitoring) or a two-way exchange of

information (e.g., request and supply of information) (Berrouiguet, Baca-García, Brandt, Walter, &

Courtet, 2016) . Interventions delivered via SMS can be stand-alone treatments (e.g., motivational

messages) or treatment adjuncts (e.g., as support for other e-mental health or more traditional

interventions).

A recent review of SMS for addictive behaviours identified 17 studies, the majority of which were

RCTs for smoking cessation with just 4 involving alcohol reduction (Keoleian, Polcin, & Galloway,

2015). Compared with SMS for smoking cessation interventions that have been associated with improved

quit rates (Keoleian et al., 2015), SMS for alcohol reduction studies report improvement in symptoms but

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not to a statistically significant level. Almost all SMS for smoking cessation studies have recruited from community settings and targeted those preparing for change (Keoleian et al., 2015), whereas most of the alcohol studies have recruited from in-patient facilities and those seeking to maintain change (Agyapong, Ahern, McLoughlin, & Farren, 2012; Gustafson et al., 2014; Haug, Lucht, John, Meyer, & Schaub, 2015; Irvine et al., 2012). Furthermore, multiple smoking cessation studies have investigated SMS as an additional intervention on top of helpline and e-mental health (Brendryen, Drozd, & Kraft, 2008; Brendryen & Kraft, 2008), but most have not evaluated SMS separately. One alcohol program was offered as part of a smart phone application package (Gustafson et al., 2014), but beyond this, there have been no alcohol studies investigating SMS as a stand-alone intervention offered in a clinical setting. Just one intervention for alcohol has offered inbound requests for support, involving a call within 24 hours from a therapist when further help was indicated by SMS (Lucht et al., 2014).

To date, there has been limited investigation of the impact of incorporating SMS into a suite of e-mental health options and no studies have specifically investigated SMS as an intervention for problem gambling. The current feasibility study investigates the impact and uptake of a 12-week proactive outbound-inbound SMS program for gamblers who are attempting change. Previous work suggests gamblers accessing e-mental health are ready to take action and see change as a priority but lack confidence in being able to resist an urge (Rodda, Lubman, Iyer, Gao, & Dowling, 2015). The current study aims to support change by providing 12 weeks of change strategies that have been found helpful for gamblers undertaking change (Lubman et al., 2015). The study recruited participants from an Australian e-mental health service (Gambling Help Online) and randomised gamblers to 12 weeks of SMS (or treatment as usual [TAU]). Two messages were delivered each week, including a check-in message ('Is help required?') and a selection of behaviour change strategies previously identified as helpful to gamblers (Lubman et al., 2015). Follow-up evaluation occurred via an online survey at 4 and 12 weeks post-randomisation. Based on previous literature from other fields (Keoleian et al., 2015), we hypothesised that gamblers allocated to SMS will demonstrate improvements in their gambling severity

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as well as reduced time and money spent gambling at 12-weeks follow-up, compared with those in the TAU condition. The use of SMS in itself may appeal to researchers and service providers as a means of offering additional support and also maintaining engagement with participants (or clients) following exposure to a brief intervention. Determining the feasibility of embedding an SMS program within a suite of e-mental health services as well as within a treatment system was therefore essential. As such, this paper also describes the recruitment and randomization workflow, implementation of the inbound-outbound program as well as whether text messages assisted in maintaining engagement with participants at 12-week follow-up evaluation.

Method

Participants and Recruitment

Recruitment of participants occurred between December 2014 and November 2015 from a national e-mental health service for gambling (Gambling Help Online) in Australia. Information on the trial was sent to participants who registered for the program and engaged in any of the available TAU e-mental health programs (synchronous chat, asynchronous email, community forum, self-help modules). Participants could access any of these options as anonymously and as frequently as needed:

- **Synchronous chat:** Chat is offered 24/7 and works similarly to instant messaging, where both the counsellor and client type in a secure environment.

- **Asynchronous Email:** Email support is provided via the same secure site as the real time chat. A client is allocated the same counsellor for two to three emails a week for approximately six weeks.

- **Website:** The website provides information on gambling issues, interactive self-assessments, and strategies for regaining control as well as accessing support and helping others. In total, the site offers over 30,000 words of content across more than 20 separate pages.

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- **Community forums**: Forums are post moderated by a clinician 7-day week. Anyone can read and create a post in the forums, including gamblers, family, friends, professionals and the general community on topics such as strategies for change and stories of recovery.

- **Very brief self-help:** Modules are intentionally brief (5 to 10 minutes) and based on motivational interviewing (Hodgins, 2002) and cognitive behaviour techniques (Raylu and Oei, 2010). Modules were *Getting started* (i.e., strengths identification, goal setting, high risk situations); and *Sticking with it* (i.e., building self-efficacy, time and money management).

Inclusion criteria was engagement with at least one service offering from Gambling Help Online, a willingness to be followed up at 4 and 12 weeks post-treatment, willingness to provide mobile phone number and a willingness to be randomised. Participants were excluded if their current location as indicated by IP address was not Australia.

Information on the project was provided to 2,482 gamblers via an email post-registration. In total, 277 consented to participate, with 249 registering for the trial. As indicated on Figure 1, 198 participants were randomised to SMS (SMS group; n=99) or Treatment as Usual (TAU group; n=99). Randomisation (with a 1:1 allocation ratio) occurred after the initial assessment was completed. To ensure equal sample sizes over time, block randomisation was conducted with block lengths of 6, and the sequence computer generated. The lead researcher used a sealed envelope technique, meaning that the research assistants who were responsible for allocating participants to their condition were blind to the allocation. All assessments were completed online (baseline, 4-week and 12-week evaluation), and each took approximately 15 minutes to complete. The initial assessment included the plain language statement, informed consent and information on where to seek further help if needed. Participants also received two cinema tickets when they reached the 12-week evaluation as a reward for their effort (no further remuneration was provided). Approval for this study was granted by the Eastern Health Human Research Ethics Committee (E01/2014).

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INSERT FIGURE 1 ABOUT HERE

Measures

A survey was developed to describe the characteristics of service users. This included demographics (i.e., gender and age), readiness to change and gambling goals (i.e., cut down, abstain, maintain goal). All of the following measures were administered at baseline as well as 4 and 12-week follow-up evaluation.

The primary outcome was **Gambling Symptom Severity (G-SAS)**, which measures gambling symptom severity. It can be used to detect change during treatment as it measures symptoms over a 7-day period (in contrast to the PGSI that was developed to measure change over 12-months) (Kim, Grant, Potenza, Blanco, & Hollander, 2009). The G-SAS is a 12-item screen that measures urges and symptom severity, frequency, duration and control on a 5-point scale (0-4). Total scores range from $0 – 48$ with extreme $= 41 – 48$, severe $= 31 – 40$, moderate $= 21 – 30$, mild $= 8 – 20$. The G-SAS has demonstrated high internal consistency ($\alpha = .87$) and good convergent validity with other measures of gambling symptom severity (Kim et al., 2009).

Secondary outcomes were frequency (days gambled) and money spent gambling and readiness to change. **Frequency and money spent gambling** was calculated over a 30-day period. Specifically, participants were asked: In the last 30 days how much time and money have you spent gambling? If you have not gambled on any of the activities type in 0. In calculating your spending, do not subtract your winnings. This question was asked against 6 broad categories of gambling activity (see Table 1). Calculating gambling frequency of gambling and money spent across a range of activities has been shown to a more reliable indicator of consumption that a single item (R. T. Wood & Williams, 2007).

Readiness to change was measured with 3 readiness rulers that we previously adapted for problem gambling (Rodda et al., 2015). These were *how important is it for you that you limit/stop your gambling* (Importance), *where does limiting/stopping gambling fit on your list of priorities?* (Readiness) and *how confident are you that you could deal with an unexpected urge to gamble?* (Confidence). Participants

responded to each of these readiness items on a scale of 1–10 with 1 being not at all and 10 being very much so.

SMS groups

Participants allocated to the TAU group were contacted online at 4 and 12-week follow-up and did not receive any SMS contact. Participants allocated to SMS were contacted via SMS one week after group allocation: "Welcome to the SMS-enhanced gambling help service, we will be sending you some helpful tips (on a Wednesday) and keeping track of your success (on a Monday) – great to have you on board." Weekly messages consisted two types of SMS. Message Set 1, which included change strategies found to be helpful for limiting or reducing gambling (Lubman et al., 2015), were delivered each Wednesday. We also took into account the likely variance in participants' readiness for change (i.e., thinking about change to maintaining change), likely previous attempts at self-help (Hing, Nuske & Gainsbury, 2011) and that not all strategies will be useful to all people. As such, messages in Set 1 were not specific to quitting and placed in the context of what others have found to be helpful. For example, the message at week 3 was "Some people find this helpful…do you have other activities to do instead of gambling? Try feel good activities that don't involve gambling" (see Supplementary File 1 for a full set of messages). Message Set 2, which prompted reflection and feedback on Set 1 (i.e., Was the quick tip helpful last week?) or determined if further help was required (i.e., Text 'help' for a call back), was delivered each Monday.

Data Analysis

Cleaning of data and correction of skewness was conducted using SPSS Statistics Version 24 and all subsequent analyses was conducted with R, version 3.3.2. Data were screened prior to statistical analysis for accuracy of data entry, outliers, non-normality, heterogeneity of variance, and heteroscedasticity. Money spent gambling was highly skewed. We first reduced extreme outliners by reducing 6 baseline data points to the next highest amount repeating this for Time 2 (2 data points reduced) and Time 3 data (3 data points reduced). We then applied a log 10 transformation that significantly improved the skewness

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of the data. To contrast differences between the groups on the primary and secondary outcome variables at 4 and 12-week follow-up, mixed model repeated measures (MMRM) analysis of variance (ANOVA) was used. There was one between-group factor with two levels: group (SMS vs. TAU); and one within-group factor with three levels: assessment time point (baseline, 4 and 12 weeks). Due to the modest response rate at 4-week and 12-week follow-up evaluation (50%), we did not use intent-to-treat procedures as these are not recommended when the follow-up rate is less than 80% (Cheema, 2014; Hollis & Campbell, 1999). Instead, a complete case analysis was undertaken where participants were included in the analysis if they had a least one piece of data at follow-up evaluation. Where there was missing data we used the last observation carried forward method. Of those who completed at least one follow-up evaluation, 10% of 4-week evaluation data was imputed and 23% at 12-week follow-up evaluation.

A thematic analysis (Braun & Clarke, 2006) was used to organise SMS responses into themes. This involved reading and re-reading responses and identifying common themes. Data were then organized into themes by the lead author using Microsoft Excel and percentages calculated.

Results

Baseline characteristics by treatment group

The majority of participants were male (60.1%), with a sample average age of 39 years (*SD*=12.1, range 20-66 years). As indicated in Table 1, the majority of participants wanted to quit gambling, with only 12 wanting to cut down and a further 27 wanting to maintain their current quit or cut down plan. Participants reported high levels of readiness and importance, but lower confidence to resist an urge to gamble. The most frequent type of gambling was EGM gambling followed by wagering and numbers games, such as lotto, keno, or bingo. The most frequent type of service accessed via Gambling Help Online was website information followed by a very brief self-help module. To determine whether there was differential attrition according to study group, we conducted a series a chi-squares analysis and t-

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tests. No baseline characteristic predicted attrition with the exception of confidence. Those with higher confidence in their ability to resist an urge (p = 0.035) were more likely to not complete a 4-week or 12-week follow-up evaluation. Being male and placing less importance on reducing or quitting gambling were moderately associated with not completing a follow-up evaluation (p = 0.072 and p = 0.077 respectively).

INSERT TABLE 1 ABOUT HERE

Impact of SMS

Table 2 presents the outcome measures at baseline and follow-up evaluations. The mixed model repeated measures (MMRM) analysis of variance (ANOVA) indicated no significant effect for group (SMS versus TAU) on the primary outcome measure: G-SAS score (F (1, 98) = 0.172, p = 0.679), with negligible effect sizes (4 weeks: d = 0.17; 12 weeks: d = 0.07). The MMRM ANOVA indicated a significant effect for time on G-SAS score (F (2, 196) = 107.7, p < 0.0001). Post hoc t-tests with Bonferroni corrections revealed a significant decrease, and large to very large effect size, between baseline and 4 weeks (p < 0.0001, d = 1.34) and baseline and 12 weeks (p < 0.0001, d = 1.12), but not between 4 and 12 weeks (p = 0.27, d = 0.11). There was no interaction between group and time on G-SAS score (F (2, 196) = 0.652, p = 0.522).

The MMRM ANOVA indicated no significant effect for group (SMS versus TAU) on the outcome measure number of days gambled (F (1, 98) = 1.09, p = 0.299), with negligible effect sizes (4 weeks: d = 0.07; 12 weeks: d = 0.11). The MMRM ANOVA indicated a significant effect for time on the number of days gambled (F (2, 196) = 45.7, p < 0.0001). Post hoc t-tests revealed a significant decrease, and medium effect size, between baseline and 4 weeks (p < 0.0001, d = 0.77) and baseline and 12 weeks (p <

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0.0001, $d = 0.70$), but not between 4 and 12 weeks ($p = 1.0$, $d = 0.08$). There was no interaction between group and time on on the number of days gambled (F (2, 196) = 1.20, $p = 0.304$).

The MMRM ANOVA indicated no significant effect for group (SMS versus TAU) on the outcome measure money spent (F (1, 98) = 2.54, $p = 0.115$), with small effect sizes (4 weeks: $d = 0.28$; 12 weeks: $d = 0.25$). The MMRM ANOVA indicated a significant effect for time on money spent (F (2, 196) = 66.2, $p < 0.0001$). Post hoc t-tests revealed a significant decrease, and large effect size, between baseline and 4 weeks ($p < 0.0001$, $d = 0.93$) and baseline and 12 weeks ($p < 0.0001$, $d = 1.00$), but not between 4 and 12 weeks ($p = 0.53$, $d = 0.14$). There was no interaction between group and time on money spent (F (2, 196) = 0.62, $p = 0.538$).

The MMRM ANOVA indicated no significant effect for group (SMS versus TAU) on the outcome measure importance of change (F (1, 98) = 0.408, $p = 0.525$), with negligible to small effect sizes (4 weeks: $d = 0.07$; 12 weeks: $d = 0.21$). The MMRM ANOVA indicated a significant effect for time on importance (F (2, 196) = 6.12, $p = 0.003$). Post hoc t-tests revealed a significant increase, and small effect size, between baseline and 4 weeks ($p = 0.002$, $d = 0.35$) and baseline and 12 weeks ($p = 0.005$, $d = 0.32$), but not between 4 and 12 weeks ($p = 1.0$, $d = 0.04$). There was no interaction between group and time on importance (F (2, 196) = 0.627, $p = 0.536$).

The MMRM ANOVA indicated no significant effect for group (SMS versus TAU) on the outcome measure readiness (F (1, 98) = 0.72, $p = 0.398$), with negligible effect sizes (4 weeks: $d = 0.01$; 12 weeks: $d = 0.02$). The MMRM ANOVA indicated no effect for time on readiness (F (2, 196) = 0.148, $p = 0.863$). Effect sizes between baseline and 4 weeks ($d = 0.05$), baseline and 12 weeks ($d = 0.04$), and 4 and 12 weeks ($d < 0.01$) were negligible. There was no interaction between group and time on readiness (F (2, 196) = 1.105, $p = 0.333$).

The MMRM ANOVA indicated no significant effect for group (SMS versus TAU) on the outcome measure confidence (F (1, 98) = 1.31, $p = 0.255$), with small effect sizes (4 weeks: $d = 0.21$; 12 weeks: $d = 0.30$). The MMRM ANOVA indicated a significant effect for time on confidence (F (2, 196) = 13.78, p

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< 0.0001). Post hoc t-tests revealed a significant increase, and small effect size, between baseline and 4 weeks ($p = 0.0005$, $d = 0.39$) and baseline and 12 weeks ($p < 0.0001$, $d = 0.44$), but not between 4 and 12 weeks ($p = 0.60$, $d = 0.13$). There was no interaction between group and time on confidence ($F (2, 196) = 0.889$, $p = 0.413$).

INSERT TABLE 2 ABOUT HERE

Responsiveness to SMS

There were 188 participant responses to the series of SMS. These messages were received from 51 different participants allocated to the SMS condition (52%). As indicated in Table 3, the most frequent participant response was about SMS in general (48%), with a further 14% of messages related to specific change strategies. Follow-up evaluation was completed by 65% of participants who responded to at least one SMS and 55% of those who did not respond at all. This difference was not significant ($p=0.06$).

There were 20 messages describing personal progress and a further 10% of messages related to the offer of help. Sixteen participants indicated a need for a call-back from the service and texted 'help' when prompted. For the most part, the request for help was texted as 'help' without further elaboration. Where the message was elaborated, this was in relation to the best time ("Help but after 4pm please", "Help but call after 7pm please") or for immediate assistance "Can someone please call me now?" Others stated their preferred mode of contact "I don't mind text or call is fine." The 16 requests for help were responded to by counselling staff from Gambling Help Online. In total, 11 requests were completed (meaning that the counsellor was able to make contact with the participant) and five participants were unable to be contacted.

INSERT TABLE 3 ABOUT HERE

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Discussion

In e-mental health, there has been a lag between practice and research, with most e-mental health programs being released before any evaluation of effectiveness has been conducted. This feasibility study is the first trial investigating the impact of an SMS intervention for problem gambling. This study hypothesised gamblers receiving SMS would report greater reduction in gambling symptoms and time and money spent gambling at 12-week evaluation than TAU. The results of the current study did not support this hypothesis. There was no difference in any outcomes at 4 or 12-week evaluation over and above accessing other e-mental health programs. These findings are consistent with previous alcohol reduction studies (i.e., improvement in symptoms but not to a statistically significant level), but not consistent with other studies reporting positive outcomes associated with SMS and smoking cessation (Keoleian et al., 2015). Similar to the current study, smoking cessation research targets those preparing for change (indicated by a desire to quit), but almost all of these previous interventions were offered as stand-alone programs (i.e., not part of a suite of services). The current study encouraged participants to seek other e-mental health offerings, and participants could continue to access whatever help they required. It may be that trial participants who accessed multiple e-mental health interventions have a finite capacity for intervention and treatment options and, at some point, adding more options does not improve outcomes. Previous research involving brief and minimal interventions for problem gambling have also reported that offering additional "booster" sessions does not make a difference to client outcomes (Hodgins, Currie, Currie, & Fick, 2009). Given the current study reported that gamblers accessed an average of 2.5 e-mental health programs at their initial visit, it could be that the mixture of service offerings more than met current needs (thereby negating any possible impact of an additional SMS intervention).

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This paper explored the recruitment and randomization workflow, implementation of the inbound-outbound program as well as whether text messages assisted in maintaining engagement with participants at 12-week follow-up evaluation. In terms of recruitment, we used a three-step strategy that involved advertising the study to clients. We then emailed those who expressed an interest in follow-up with a link to the study. By embedding this process within the service setting, we were able to relieve the clinician of the burden of recruitment and were able to recruit clients who did not access a person-to-person service (i.e., forums, website or self-help). This meant that the sample recruited was not the entire population of clients, but this is consistent with community-based studies where many are advised of the study but few go on to participate. We did, however, find that demographic characteristics and gambling indicators appear similar to the wider population of online help seekers (Rodda & Lubman, 2014). In terms of randomisation, the three-step method of recruitment meant participants seamlessly moved from a service delivery platform to a survey site managed by the research team, whereby randomisation could occur following consent to participate. Randomisation was conducted by a research assistant and participants were informed via text message if they had been included in the SMS intervention. Future research may consider more efficient methods whereby group allocation is made via electronic means at the time of consent (e.g., a program embedded in the survey software).

This research also explored whether text messages assisted in maintaining engagement with participants at 12-week follow-up evaluation. Engagement was measured by the proportion of participants who responded to messages, the proportion of participants who requested additional support and the proportion of participants who completed follow-up evaluation. Over half of participants sent at least one SMS over the course of the trial and this was most frequently a general response towards messaging rather than the content of a specific message. This suggests messages in themselves may be acceptable, but perhaps the content of messages in the current study could be improved. Messages were based on preliminary findings from a study investigating change strategies for problem gambling. Our recent research suggests gamblers use various combinations of change strategies and that focusing on the

implementation of groups of change strategies (e.g., how to set limits) may be a useful approach (Rodda, Hing, et al., 2016). Furthermore, studies in smoking cessation reporting improved outcomes compared with control groups offer SMS for much longer periods of time (i.e., up to 26-weeks) (Whittaker et al., 2012). Future studies should examine whether a longer duration of SMS is associated with improvement over and above the control condition. In terms of requesting additional assistance, around 10% of gamblers accessed this outbound service which is a similar rate to previous findings (Haug et al., 2015; Lucht et al., 2014). Given that gambling is associated with high rates of relapse (Smith et al., 2015), SMS is potentially a low intensity means of identifying those in need of further assistance.

The proportion of participants who completed follow-up evaluation was lower than expected and SMS did not improve retention rates at follow-up evaluations. Studies involving online participants frequently report follow-up rates as low as 10-25% (Murray et al., 2009). This is because low thresholds for participation (which is valued by participants), together with the convenience of online access mean higher rates of attrition than reported in traditional face-to-face intervention research. The current study did not collect any identifying information beyond an email address and this hampered our ability to conduct follow-up evaluations more assertively. Future studies may consider the balance between participant anonymity (which is valued by online service users) (Rodda, Lubman et al., 2013) and obtaining sufficient contact details such that rates of attrition at follow-up evaluation may be reduced.

The data provide a conduit to further development of intervention and recruitment strategies, and offer empirical estimates of within group statistical parameters for future power calculations (e.g. G-SAS). Our study provides tentative information that can inform future studies for sample size calculations (i.e., we used well-established measures and used a missing data strategy). To address the issue of participant attrition at follow-up evaluation, we used a single imputation method (last observation carried forward) but this has several drawbacks. This includes missing the informative properties of missingness and not accounting for error in imputed values that can lead to anti-conservative estimates of standard errors. We used a large block size of 6 which, given the probable high rate of attrition in future similar

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trials, could produce an imbalance. Future studies should consider varying block sizes (e.g., 2 and 4) to ensure allocation concealment. To address participant attrition from follow-up evaluation, we compared baseline characteristics and study retention and found few significant differences between those that received SMS and those that did not. Being male and placing less importance on reducing or quitting gambling was moderately associated with not completing a follow-up evaluation. This is an important finding in terms of field-testing a logistical aspect of the study design. It suggests participants who are male and also those reporting low importance of change may need more encouragement to participate in research and follow-up evaluations. Future studies could determine whether appealing to pro-social motivations (e.g., helping others) could improve rates of follow-up evaluation for these participants.

The range of technical responses to addictive behaviours is continuing to grow rapidly and, for the most part, research in this field lags behind practice. Like any other technological solution, SMS is a means of delivering a therapeutic intervention rather than an intervention in itself. Interventions still need to be developed with a clear purpose and aim, as well as understanding of the intervention's underlying mechanisms. Our understanding of the optimal delivery of SMS is still developing in terms of message frequency and timing, duration and type of interaction (e.g., one-way versus two-way exchanges) (Hall, Cole-Lewis, & Bernhardt, 2015). From a service delivery perspective, the ultimate capability of SMS in counselling situations promises great versatility in terms of the low cost of establishment (i.e., inexpensive off the shelf software is available), ease of use (i.e., in current study we were able to set up an automated delivery schedule over a specified period of time) and burden on clinician time. The current study indicates the importance of conducting randomised trials, even where evidence is still developing. Other open label studies have reported SMS is associated with good outcomes for addictive behaviours (Reback et al., 2012), however the inclusion of a control group tentatively suggests that improved outcomes may be attributable to other study characteristics and not the SMS. Nevertheless, current and previous studies (Haug et al., 2015; Keoleian, Stalcup, Polcin, Brown, & Galloway, 2013) indicate SMS is acceptable, viewed positively, and of interest to people with addictive behaviours. This suggests more

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work needs to be conducted in determining the content, timing, frequency and duration of SMS when

offered as part of a suite of interventions.

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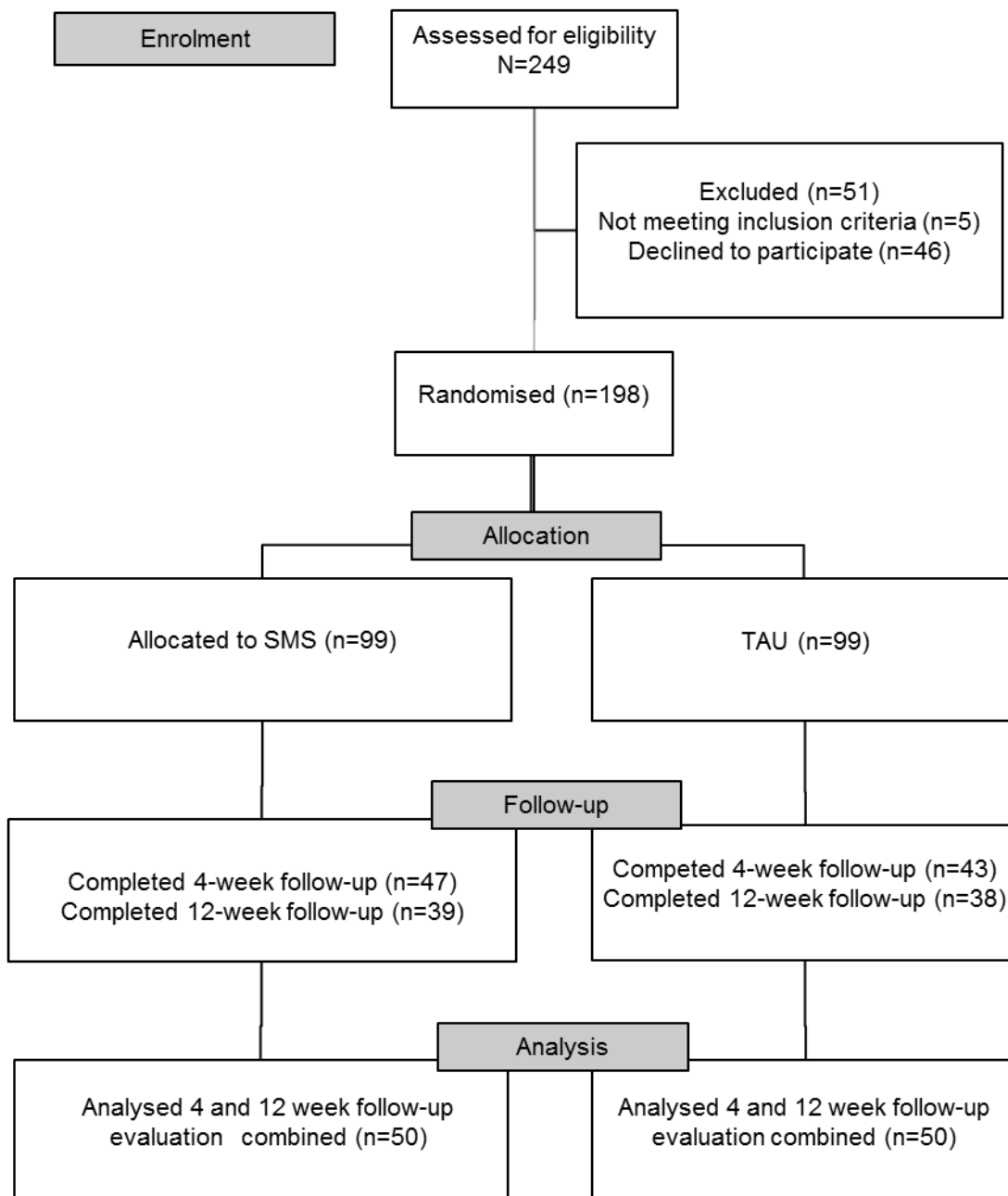
Figure 1. Participant flow chart into study

Table 1: Baseline Characteristics by Treatment Group (n, %)

Characteristic	TAU (n=99)	SMS (n=99)	Total (n=198)
Age (*M, SD*)	39.5 (11.9)	39.1 (12.5)	39.3 (12.2)
Male gender	61 (61.6)	58 (58.6)	119 (60.1)
Gambling goal: Cut down	6 (6.1)	6 (6.1)	12 (6.1)
Gambling goal: Maintain	15 (12.2)	12 (12.1)	27 (13.7)
Gambling goal: Quit	78 (78.8)	81 (81.8)	159 (80.3)
Readiness to reduce or quit (*M, SD*)	9.0 (1.6)	8.6 (2.3)	8.8 (2.0)
Importance to reduce or quit (*M, SD*)	9.7 (.6)	9.7 (.8)	9.7 (0.7)
Confidence to resist an urge (*M, SD*)	5.7 (2.6)	5.4 (2.6)	5.5 (2.6)
Type of gambling			
Private betting (e.g., cards at home)	4 (4.0)	1 (1.0)	5 (2.5)
Electronic gaming machines	73 (73.7)	68 (68.7)	141 (71.2)
Table games (e.g., poker, roulette)	11 (11.1)	15 (15.2)	26 (13.1)
Racing (e.g., horses, dogs)	43 (43.4)	41 (41.4)	84 (44.9)
Numbers games (e.g., lotto, bingo)	32 (32.3)	42 (42.4)	74 (37.4)
Sports betting (e.g., football or events)	27 (27.3)	27 (27.3)	54 (27.3)
E-mental health accessed			
Talked to a counsellor via chat	51 (51.5)	39 (39.4)	90 (45.5)
Read or contributed to the online forums	38 (49.4)	39 (39.4)	77 (38.9)
Sent an email to a counsellor	25 (25.3)	18 (41.9)	43 (21.7)
Read the website to source information	83 (83.8)	91 (91.9)	174 (87.9)
Completed a self-help module	61 (61.6)	56 (56.6)	117 (59.1)
G-SAS score (*M, SD*)	29.2 (7.9)	30.3 (7.6)	29.7 (7.8)
Days gambled (*M, SD*)	17.0 (15.3)	18.7 (16.5)	17.8 (15.9)
Money spent ($) (*M, SD*)	3575 (4048)	4098 (5271)	3837 (4696)

Table 2. Outcome measures at baseline and follow-up evaluation by SMS or TAU (*M, SD*)*

	Baseline	4-week evaluation	12-week evaluation	Interaction between group and time	
				F (2,196)	P value
G-SAS score				*F* = 0.63	p = 0.52
SMS	30.5 (7.8)	16.2 (10.1)	17.7 (11.0)		
TAU	30.0 (9.0)	18.0 (10.2)	18.5 (11.9)		
Days gambled				*F* = 1.20	p = 0.30
SMS	19.9 (15.2)	8.4 (12.7)	7.9 (11.7)		
TAU	15.6 (13.1)	7.6 (9.1)	6.8 (9.2)		
Money spent				*F* = 0.62	p = 0.54
SMS	3451 (4464)	1244 (2598)	649 (1181)		
TAU	3068 (2542)	1279 (1711)	1145 (1595)		
Importance				*F* = 0.63	p = 0.54
SMS	9.7 (0.8)	9.4 (1.1)	9.5 (1.0)		
TAU	9.7 (0.7)	9.3 (1.6)	9.3 (1.5)		
Readiness				*F* = 1.11	p = 0.33
SMS	8.6 (2.3)	8.7 (2.0)	8.7 (1.8)		
TAU	9.0 (1.6)	8.7 (2.1)	8.7 (2.0)		
Confidence				*F* = 0.89	p = 0.41
SMS	5.4 (2.6)	6.5 (2.9)	7.0 (2.9)		
TAU	5.7 (2.6)	5.9 (3.1)	6.1 (3.2)		

*SMS: n = 50; TAU: n = 50

Table 3. Message content received from clients (n, %)

Content of client response	*n*, %	Indicative response
Response towards messaging (i.e., not specific to any particular change strategy)	90 (48)	• Yes keep them coming in doing well but need the constant reminders • Thanks for the SMS they just confirm to me I am on the right track • You know what's helpful? Having a message every week that says "hope you are well • Yes, I am finding both these SMS contacts and online forums really thought provoking and useful. Have already put quite a few strategies in place, and a few more in the pipeline
Response specific to the change strategy	26 (14)	• Somewhat helpful. So far I have enough inspiration. Been noticing the impulses and the constant adverts, but doing well • Yes, it helps to keep non gambling activities at the forefront of my mind • Ty I am doing ok. I have deleted FB and felt relieved after. Thanks for the SMS they just confirm to me I am on the right track :) • I don't want to set limits, I just want to stop completely
Response to offer of help	18 (10)	• At this stage I'm ok thanks but will text if I need to chat • Please send me more info you refer to thanks
Shared account of recovery	20 (11)	• Going well- Haven't punted in the last week • I have not had a gamble since I started the counselling thank you • I do have to be stronger to be successful.
Request for call-back	16 (9)	• Help but after 4pm please
Technical problems	12 (6)	• I don't think I got a quick tip last week but all is good • I lost all my contacts, who is this?
Request to opt out (e.g., messages no longer required)	6 (3)	• Can I please be removed message list? Thanks. I don't like the messages pop up on phone • Happy to stop the text messages now please. Thanks for your help but I no longer require the messages

Supplementary File: Content of SMS

- Some people find this helpful…Do you have enough inspiration? Blogs, books and online forums tell how others have done it.
- Some people find this helpful…Do you practice setting limits on time or money spent gambling? Be clear on how much is ok and make a plan to stick with it.
- Some people find this helpful…Do you have other activities to do instead of gambling? Try feel good activities that don't involve gambling.
- Some people find this helpful…Practice relaxation strategies like yoga, meditation or even start a new hobby – also remember to complete your 4-week check-in.
- Some people find this helpful...Do you have enough information about how gambling problems develop and the options for treatment?
- Some people find this helpful…It's helpful to spend more time with family and friends and less time alone.
- Some people find this helpful…Do you have too much access to cash? Ask others to hold on to cash or cards.
- Some people find this helpful…Can you change your focus away from gambling? Team sport or group activities can help.
- Some people find this helpful…Talk about all the positive steps you have taken. You could keep a diary or record of achievements.
- Some people find this helpful…Plan to eat a healthy balanced diet with less sugar and caffeine. This has been shown to help people get a good night's sleep.
- Some people find this helpful…Get distracted from gambling. Take a walk, cook a meal, go to the movies.
- Some people find this helpful…Think about how your money could be better spent – also remember to complete your 12-week check-in.