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Structural Changes to Electronic Gaming Machines as Effective Harm Minimization Strategies for Non-Problem and Problem Gamblers

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This study aimed to evaluate the effectiveness of three proposed modifications to the structural characteristics of electronic gaming machines as harm minimisation strategies for non-problem and probable problem gamblers. Structural changes included reducing the maximum bet size, reducing reel spin and removing large note acceptors. Behavioural patterns of play were observed in 779 participants attending clubs and hotels. Observations were conducted in the gaming venue during regular gaming sessions. Eight experimental machines were designed to represent every combination of the modifications. 210 participants played at least one modified and one unmodified machine. Following play, the South Oaks Gambling Screen (SOGS) was administered. More problem than non-problem gamblers used high denomination bill acceptors and bet over one-dollar per wager. Machines modified to accept the one-dollar maximum bet were played for less time and were associated with smaller losses, fewer individual wagers and lower levels of alcohol consumption and smoking. It was concluded that the reduction of maximum bet levels was the only modification likely to be effective as a harm minimization strategy for problem gamblers.

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INTRODUCTION

In 1899, Charles Fey designed the original 'Liberty bell' mechanical three-reel slot machine featuring an automatic payout system, a derivative of earlier popular counter-top 'nickel-in-the slot' machines where wins were paid with tokens redeemable for drinks or cigars (Marfels, 1999). Since then, technological advances have led to substantial changes to the structural characteristics of these mechanical devices including the introduction of computerized virtual reels, multiple line and credit facilities, free-spin and double-up features, interactive touch-screens and linked jackpots increasing their attractiveness to players. Electronic gaming machines (EGM) are variably referred to as 'poker-machines' in Australia, 'slot machines' in America, 'video lottery terminals (VLT)' in Canada, and 'fruit machines' in the United Kingdom.

Legislative changes and competitive market forces over the past decade have led to an expansion of these gaming devices within Western communities (Bondolfi & Ladouceur, 2000; Ladouceur, Jacues, Ferland, & Giroux, 1999; Productivity Commission, 1999; Shaffer, Hall, & Vander Bilt, 1999). Electronic gaming machines in the form of video draw poker, blackjack, Keno, slot machines and VLTs now represent the predominant form of gambling accounting for up to 60% and, in some jurisdictions 90%, of net gambling expenditure (Marfels, 1999; Productivity Commission, 1999).

Paralleling this increased availability has been a steady increase in the number of gamblers reporting impaired control over electronic gaming machine play (Walker, 1992). It has been argued that these electronic gaming machines are highly popular and represent the 'crack cocaine of gambling' because of their capacity for 'continuous' play, speed of action and immediate gratification, ability to generate excitement, are found in safe environments and have other powerful reward properties that make them very attractive to players (Korn & Shaffer, 1999). In addition, the

inherent variable ratio of reinforcement (wins) is particularly resistant to extinction and, in combination with multiple linked machines increasing the potential prize pool, fosters persistence in play (Dickerson, 1990).

In response to community and public pressure, governments and sectors of the gaming industry have acted to initiate putative harm minimization strategies and codes of responsible gaming that are designed to protect players. The concept of harm minimization or harm reduction originated from public health interventions aimed at reducing the spreads of blood-borne infections associated with intravenous drug use (Peterson, Dimeff, Tapert, Stern, & Gorman, 1998). Subsequently, the principles of harm minimisation have been applied to substance use including alcohol. Phenomenological similarities between pathological gambling and alcohol abuse, such as tolerance and withdrawal, have led to the application of harm minimisation approaches to gambling (Shaffer, 1999).

The public health perspective draws a number of parallels between gambling and alcohol use (Korn & Shaffer, 1999). Both alcohol and gambling are legal activities for adults in most Western societies; both involve highly regulated industries from which governments earn substantive tax revenue; laws prohibit minors from consuming alcohol and participating in gambling. Unlike other addictions such as smoking cigarettes, it is generally accepted that there are safe levels of usage associated with alcohol and gambling (Korn & Shaffer, 1999). There is a general consensus that the majority of the adult population, at least on occasion, consume alcohol and gamble. In general it is agreed that prohibition is neither a viable nor desirable goal. Such points of comparison between addictions and gambling have led many governments to focus their attentions on harm minimization strategies for managing the increasing problems associated with gambling to excess.

A review of the literature relating to harm minimization strategies and problem gambling suggests a paucity of research has been conducted. Loba, Stewart, Klein, and Blackburn (2002) investigated differences in self-ratings in response to changes to the design of commercially available VLT machines within a laboratory setting in a sample of 31 pathological and 29 non-pathological regular gamblers recruited through advertisements. Pathological gamblers were diagnosed according to criterion threshold scores on the South Oaks

Gambling Screen (Lesieur & Blume, 1987). These authors aimed to identify game parameters that would reduce the risk of abuse of VLTs by pathological gamblers while exerting minimal effects on the behaviour of non-pathological gamblers.

These researchers found that decreasing the speed of play and turning off sound decreased self-rated subjective levels of enjoyment, excitement and tension-reduction for a sample of pathological gamblers relative to a sample of regular gamblers. Pathological gamblers reportedly found it more difficult to cease playing than non-pathological gamblers but only on control machines (i.e. at fast speed with sound). This sample also reported a lack of willingness to play the game again if a running total in cash (as opposed to credits played) was displayed. These findings were interpreted to suggest that concrete changes to VLTs should make the game less addictive to the problem gambler while not decreasing VLTs entertainment value for the casual player. However, the laboratory setting, small sample size and reliance on self-report limit the conclusions that can be drawn from this study. Indeed, the authors stressed the need for these findings to be replicated in natural settings.

In the absence of data, governments have largely proposed and implemented harm minimization strategies that have face validity, but lack empirical evaluation. Consequently, whether these strategies are effective, ineffective or have the potential of producing unintended harmful outcomes remains unknown. Given the increasing importance of evidence-based medicine in decision-making related to health policies and interventions (Craig, Irwig, & Stockler, 2001), the absence of research in this area is of particular concern.

In New South Wales, the Liquor Administration Board is a regulatory body that maintains a statutory duty over the responsible conduct of gaming activities in the state. In 2000, the Board reviewed certain technical standards of gaming machines and in light of the Productivity Commission's (1999) recommendations, accepted a number of initiatives for provisional implementation by gaming machine operators. Three of these proposals included: (1) a 90% reduction in maximum bet per wager from $10 to $1; (2) a 43% reduction in reel spin speed for each wager cycle from 3.5 seconds to 5 seconds with 1 second break between plays, to prevent participants from continuous play; and (3) the reconfiguration of note acceptors to allow the insertion of $5, $10 and $20 notes but not $50 and $100 notes.

To understand the potential impact of these proposed changes to the patterns of play amongst problem and non-problem gamblers, it is important to identify how such changes may impact on the usual patterns of play amongst patrons in gambling venues. In order to be confident that specific harm minimization strategies are likely to be effective in reducing harm for problem gamblers, the following need to be demonstrated:

(a) The variables modified are used more frequently by problem than non-problem gamblers; and
(b) That introducing the changes influences patterns of play.

The present study was designed to investigate changes in patterns of play between non-problem and probable problem gamblers following the introduction of the three proposed changes to the design of gaming machines. The variables of interest were the proportion of players routinely wagering in excess of one dollar per bet, the proportion playing with rates of wager cycles faster than 5 seconds, and the proportion inserting high denomination note acceptors. It was hypothesized that, on standard machines, a higher proportion of problem gamblers would exhibit patterns of play that included bets in excess of $1, faster rates of play and the use of $50 and $100 as compared to non-problem players. It was further hypothesized that modified machines would result in changes to patterns of play consistent with a reduction in the potential for gambling-related harm, that is, a reduction in playing time and net expenditure on modified as compared to unmodified machines.

METHOD

Participants

Seven hundred and seventy-nine participants attending seven hotels and four club venues with the specific intent to gamble on gaming machines agreed to take part in the present study. Of the total sample pool, SOGS scores were obtained on 634 participants. For between machine comparisons, data was extracted from 210 participants who played at least two of the experimental machines. All

participants were observed while playing machines of their own choice and with their own funds.

Participants were recruited from seven hotels and four club venues in New South Wales. All hotels and two clubs were located in the Sydney metropolitan area, one club in a metropolitan area outside of Sydney, and the remaining club in regional New South Wales. Venues were chosen on the basis of operators agreeing to allow researchers access to patrons gaming on their premises and therefore participating venues reflect a sample of convenience that is not representative of all hotels or clubs in the state.

Seventy-six percent of the participants were recruited from club venues and the remainder from hotels. The mean age of the sample was 46.1 years (SD = 17.9 years). The mean SOGS score was 2.43 (SD = 3.43). Lesieur and Blume, in their discussion of SOGS scores, label individuals who score three or four as ''problem gamblers'' and those who score five or more as ''probable pathological gamblers''. In this study, participants scoring five or more are referred to as problem gamblers. This more stringent criterion was applied in order to ensure that those identified as problem players were highly likely to have problems with their gambling. Since less than 10% of the sample scored in the 'at risk' range ($n = 19$), this group was too small for reliable statistical analyses. Participants with scores of less than five are referred to as non-problem gamblers. Twenty percent of the sample scored more than five on the SOGS.

Procedure

For this study, the gaming machine manufacturer provided and modified 14 machines, that were otherwise identical, to meet the technical requirements of the proposed design changes. Seven machines were designated as control machines (Machine E). These control machines were standard configuration one-cent Aristocrat Leisure Technologies 'Pirates' machines which included a maximum bet of \$10 (20 lines × 50 credits), a wager cycle speed set at 3.5 seconds, continuous play capability and accepted notes of denominations to the value of \$100. The 'Pirates' machine is a clone of a game called 'King Ra' which itself was based on the popular 'Queen of the Nile'. According to industry sources, the one-cent 'Queen of the Nile' machine is one of the most popular machines played in New South

Wales (Aristocrat Leisure Technologies, personal communication). The remaining seven machines were systematically modified according to one or more of the independent variables (proposed design changes) to cover all possible combinations:

A. Maximum bet $1, Reel spin 3.5 seconds, all denomination notes accepted
B. Maximum bet $1, Reel spin 5 seconds, all denomination notes accepted
C. Maximum bet $1, Reel spin 3.5 seconds, $20 maximum note accepted
D. Maximum bet $1, Reel spin 5 seconds, $20 maximum note accepted
E. Maximum bet $10, Reel spin 5 seconds, all denomination notes accepted
F. Maximum bet $10, Reel spin 3.5 seconds, $20 maximum note accepted
G. Maximum bet $10, Reel spin 5 seconds, $20 maximum note accepted

Modified and unmodified machines were set to provide the usual expected player return rate of 87.5% stipulated by legislative requirements for standard machines in New South Wales.

In the seven hotel venues, two machines (one control and one of the seven experimental machines) were placed adjacent to each other to control for such factors as floor location, proximity to main thoroughfares and lighting. The management in each venue chose the actual location for the placement of these experimental machines.

Data collection in hotels was conducted over five hours per day over seven consecutive days. To increase recruitment, peak periods of machine usage were sampled. Peak periods were determined by reference to the graphical representations of the average daily distribution of gross expenditure for venues provided by the management. Accordingly, the majority of the observational periods were conducted in the evening. Two hotels withdrew from the study after five days of recruitment citing concern over reduced revenue as the primary reason.

For club venues, eight machines representing every combination of the three proposed design changes, including the control machine, were placed together in a 'bank' of machines. Club management determined

the location of machines. As in hotels, data collection in the clubs occurred over seven consecutive days, although research assistants were present for ten hours per day. Times chosen varied allowing sampling to occur over all time periods with the exception of the hours between 1 a.m. and 9 a.m. for two reasons: consideration for the personal safety of research assistants leaving venues in the early hours of the morning and the low number of patrons gambling at these times.

To maximize recruitments rates, posters and signs informing patrons of the nature, and purpose of the study and affiliation of the researchers were prominently displayed around the gaming floor. In clubs, the public announcement system was also used to announce to patrons that the research was in progress and to request their voluntary participation. To recruit participants, patrons were invited to participate as they approached or entered the gaming floor with the apparent intent of playing a machine. Every attempt was made not to approach patrons once they commenced playing a machine. All participants gave informed consent in accordance with the University of Sydney's Human Ethics Committee approved protocol.

Patrons who volunteered were informed that a research assistant would observe their play in as unobtrusive a manner as possible. All participants played with their own money and were instructed to play exactly as they had intended independent of the research.

Researcher assistants recorded the following variables: amount entered into machines, number of bets, number of lines and credits selected per bet, money withdrawn from machines, total duration of the session, use of note acceptors, cigarettes smoked, number of alcoholic drinks consumed and visits to the automatic teller (cash) machines (ATMs).

Measures

On completion of their session of play, participants were administered the South Oaks Gambling Screen (SOGS) (Lesieur & Blume, 1987) to obtain an index of their gambling severity. The SOGS is a brief inventory to screen for potential problems with gambling. It has demonstrated good reliability and validity and a cut-off point of five or above has been used to classify those with a lifetime history of probable problem gambling (Lesieur & Blume, 1987). We chose to use the lifetime history version, rather than a recent version, on the basis that

those with prior gambling problems who were present in gambling venues with the intention of gambling are likely to be at risk of future problems, even if their problem is not current. Further, targeted harm minimization strategies should be aimed at these individuals as well as those with current problems.

RESULTS

The majority of players maintained consistent bet sizes with the exception of times when they were deliberately playing down their credits (i.e. they had 15 cents remaining and therefore could not bet over 15 cents per wager). Therefore, the median bet size was considered to be more appropriate to use in determining the proportion of players who bet amounts greater than one dollar on standard machines. Only a relatively small proportion of players (3.5%, $n = 497$) were observed to routinely wager in excess of one dollar per bet. Chi square comparisons revealed that proportionately more probable problem (7.5%) than non-problem (2.3%) participants (Chi-square = 6.807, $p = .03$) bet amounts greater than one dollar per wager.

Results showed that a minority of players (12.8%, $n = 514$) inserted notes with denominations higher than $20 in value. However, there was a significant difference in the usage of this feature between probable problem and non-problem participants with 22% of probable problem as compared to 10% of non-problem participants inserting notes with denominations greater than $20 (Chi-square = 14.079, $p = 0.007$).

To calculate the proportion of players who played faster than a 5 second cycle, the number of total bets was divided by total time played. Results showed that the majority of players played within the five-second parameter with only 11.6% ($n = 332$) participants observed to play at a wager cycle rate faster than five seconds. There was no difference found in the proportion of probable problem (14.7%) and non-problem gamblers (12%) who played in wager cycles faster than five seconds across sessions of play.

Characteristics of Play

On average, in the sample of 210 players who played at least two modified machines, players gambled for 31 minutes (SD = 46.1),

making an average of 211 bets (SD = 294). The mean number of machines played by the patrons in the entire episode of gambling was 3 (SD = 3.7). The majority of players used the maximum number of lines (i.e. 20 or 25 depending on the machine) with the minimum number of credits (i.e. 1) on most occasions. The average loss per session was $19.85 (SD = $43.3).

Modified Machines and Patterns of Play

Two hundred and ten participants played at least two of the experimentally modified machines in either hotels or clubs. The number of participants that played one of the eight types of modified machine varied between 8 and 30. The data was not normally distributed and non-parametric analyses have been used to compare machines with and without each modification in separate analyses.

Mann-Whitney *U*-tests on the patterns of play between those machines with a maximum bet limited to one dollar in comparison to those with a ten dollar maximum revealed significant differences on a number of variables. As shown in Table 1, compared to those playing modified one-dollar maximum bet, participants on standard machines with $10 maximum bet were found to spend more time on the machines ($U_{(1,170)} = -2.920$, $p = .03$), place more individual bets ($U_{(1,205)} = -2.012$, $p = .04$), sustain greater loses ($U_{(1,208)} = -2.485$, $p = .013$), smoke more cigarettes ($U_{(1,208)} = -2.248$, $p = .025$) and consume more alcohol ($U_{(1,207)} = -3.471$, $p = .001$). No differences between these samples were found on the number of lines and credits played, use of note acceptors or use of ATMs.

It was not possible to identify whether these patterns were specific to probable problem gamblers as an insufficient number of probable problem gamblers were available in the analysis.

Mann-Whitney *U*-tests were also performed to determine differences in patterns of play between participants who played machines with fast (3.5 seconds) as compared to slow (5 second) reel spin speed, and for machines with and without the high denomination bill acceptors. No differences were observed on any of the following variables: time spent on machines, number of bets placed, amount lost, number of lines or credits played, alcohol and cigarette consumption, and number of visits to ATMs.

Table 1
Differences between Control and Experimental Machine According to the Particular Modification. Positive Differences Indicate Reductions in Aspects Associated With the Introduction of the Modification

Difference between Control and Experimental Machine	*Maximum Bet $1*	*5 Second Reel Spin Speed*	*Note Acceptors Modified*
Time spent gambling	4.6 minutes**	−2.7 minutes	1.52 minutes
Number of bets	11.73*	−6.7	0.56
Credits per line	0.03	0.26	0.29
Lines per wager	−0.29	−0.02	−0.13
Net Loss	$5.19*	$2.32	$4.58
Use of bill acceptors > $20	0.57	0.24	0.55
Cigarettes smoked	0.11*	0.01	−0.06
Alcohol consumed	0.22**	0.0	0.02
ATM visits	0.02	0.03	−0.02

*$p < .05$; **$p < .01$.

DISCUSSION

The present study hypothesised that more problem gamblers would bet in excess of one-dollar per wager, play in wager cycles faster than five seconds and use bill acceptors. Two of the three hypotheses were supported. It was found that participants with SOGS scores greater than five were more likely to bet amounts greater than one dollar per wager and were more likely to use higher denomination bills than those with SOGS scores of less than five. However, the proportion of probable problem gamblers who played in cycles faster than five seconds per was no different to the proportion of non-problem gamblers.

It was also predicted that each modified machine would be associated with a reduction in the amount of time spent gambling and net loss to participants. Of the three proposed modifications, only reduction in maximum bet to one dollar appeared to show any evidence for a potential to reduce harm associated with gaming

machine play. Participants playing experimental machines with the one dollar maximum bet modification were observed to play for less time, make fewer wagers, lost less money and consumed less alcohol and fewer cigarettes during sessions. These results suggest that although probable problem gamblers might use higher denomination note acceptors more frequently than non-problem gamblers, reconfiguring machines to accept only lower denominations notes did not influence their patterns of play.

While these results suggest that certain modifications may represent potentially effective harm minimization strategies for problem gambling, the present study has a number of limitations to its design that must be noted. Firstly, it is likely that participants who volunteered for this study may not have been representative of all patrons in the venues. It was not possible to calculate the proportion of participants who agreed to take part in the study as a percentage of the total eligible, or to obtain demographic data to establish whether the sample was in fact representative. Anecdotally, a sizeable proportion of those approached declined to participate in the study. This is particularly unfortunate since one interesting finding in the present study is the very high rates of problem gambling identified, even using the more stringent cut-off of greater than five. Most prevalence studies report past year rates of problem gambling in 1–3% range, and even though estimates in Australia are at the high end of this range (Productivity Commission, 1999), the rate of 20% found is this study is considerably higher. There are a number of explanations for this finding. Firstly, prevalence studies are conducted on samples representative of communities, whereas our sample were people who frequented gaming venues with the intention to gamble. Since problem gamblers would be considerably more likely on any given day to be present in a particular venue, it is likely that they were over-represented. The fact that we used a lifetime SOGS measure may also have inflated the observed rates. It is, of course, possible that problem gamblers were more likely than others to volunteer for this study, however, we believe that this is unlikely and indeed the reverse was the case. Anecdotally, those patrons who were present in venues every night and gambled heavily were noted to be reluctant to volunteer to take part in the study. Similarly, the majority of participants were Caucasian, despite a broader cultural representation present among those attending venues who have been reported to have higher rates of gambling problems.

While intuitively, it can be argued that problem gamblers were reluctant to volunteer for the study, clearly it is difficult to empirically determine whether this occurred. Nonetheless, the extent to which results could be generalized to all players of electronic gaming machines is unclear.

The second potential methodological difficulty relates to demand characteristics. It is possible that the process of observation by a researcher in itself may influence patterns of play. Participants may have changed their pattern of regular play while being observed. For example, patrons may have wagered less money or played more slowly to appear more moderate in their play or due to the distraction of an observer. Observers made every effort not to talk to participants but inevitably when participants spoke to the researcher, they replied. It seems a reasonable assumption that players will gamble more conservatively during observations. If this is the case, then the proportion of players who bet in excess of one dollar, play faster than one bet every five seconds or use higher denomination note acceptors may be underestimated in the present findings. Nonetheless, it is unlikely that players would be differentially affected by observation when playing different machines and as such this should not affect between machines comparisons. In addition, we did not assess the intention of patrons prior to their initiating their gaming session. Therefore it is impossible to know whether any features of the machines may have affected prior intentions. That is, do normal machines result in players gambling longer than intended; or do modified machines reduce the gambling intended? However, had we asked about intentions prior to gambling, then it is likely the possible demand characteristics may have been further accentuated. Nonetheless, future research could investigate the role of machine modifications in gambling intentions.

The third limitation of the study is that because the machines were identical with the exception of the modifications and were located adjacent to each other, if a patron did not like a particular machine, they could simply choose another machine that was in every other respect identical. Thus, the reduction in play may be due to players changing machines rather than reducing levels or patterns of gaming behaviour. However, if this was the case one might expect that the number of machines played would be different between those who played machines with reduced maximum bet facility and those who played the unmodified machines. This is an unlikely explanation given

that the numbers observed playing modified and unmodified machines were similar across different machines. Nonetheless, without repeating the observations in one venue with all machines modified and comparing the play of their patrons with a matched venue where none of the machines have been modified, this explanation can not be entirely excluded.

Unfortunately, there were an insufficient number of probable problem gamblers in the sample to compare whether these modifications were differentially effective for problem gamblers in comparison to non-problem gamblers. Optimally effective harm minimization strategies should affect the play of problem gamblers while maintaining the enjoyment and play of non-problem gamblers. Hence, the present study is only able to investigate a universal approach to harm minimization. While this study cannot examine the differential impact of the three modifications on probable problem versus non-problem players, probable problem players were three times more likely to bet in excess of one dollar routinely than non-problem players and only 2% of non-problem players did so. Therefore, it seems likely that this modification would exert the majority of its impact on probable problem gamblers. Moreover, a recent study has demonstrated that the number of credits per line is predictive of problematic levels of gambling (Sharpe et al., submitted). Since the only way to bet in excess of one dollar is to bet in excess of five cents per line, this provides further support for the contention that limiting the maximum bet is likely to limit the harm associated with problematic levels of gambling.

The harm minimization strategies tested in this study were chosen by governmental agencies as likely effective strategies with high face validity. However, they were not theoretically derived and there was no control over the harm minimization strategies to be tested in the present study. All three strategies were based on the rationale of trying to limit the losses that gamblers are likely to make during a particular period of play. That is, by limiting the maximum wager per bet, accepting lower denomination notes and slowing down the machines players are able to risk less money in a given time period. There are, however, other types of harm minimization strategies that focus on interrupting play after particular intervals (e.g. time criteria or amount lost) aiming to give players the opportunity to consider their options and break the cycle of play. Similarly, other harm minimization strategies that reduce the reinforcement inherent in machines, such as

changing pay-out schedules, changing features of the game or reducing noise, are also potentially useful but were not tested here. The evidence-based literature on harm minimization strategies for problem gambling is in its infancy and it may be that harm minimization strategies targeting factors other than limiting the amount put at risk would in fact be more effective. Future research should target other such strategies, particularly those based on theoretical grounds. For example, cognitive-behavioural theories would suggest that changing the aspects of machines that promote arousal or the development of unhelpful cognitions may be particularly beneficial (Blaszczynski & Nower, 2002; Sharpe, 2002).

Despite these limitations, the present study has considerable ecological validity. In this naturalistic study, patrons attending gambling venues with an intention to gamble were recruited. No attempt was made to influence or change the participants' intended pattern of gaming and all participants played with their own money. A large sample of participants was recruited with observations sampling each day of the week from clubs and hotels at different times of the day. The experimental machines were reconfigured to ensure that each machine was identical to the control machines with the exception of the three proposed modifications systematically manipulated.

In summary, this study specifically aimed to assess the degree to which three government proposed strategies would be effective in minimizing problems associated with gambling. There was no evidence from the statistical analyses of data that reducing the speed of the wager cycles on electronic gaming machines would be an effective harm minimization strategy. Although one study (Sharpe et al., submitted) has reported that problem gamblers play more quickly than non-problem players, the present study found that they do not play faster than every five seconds. These rates of play are consistent with play rates cited in previous research (Dickerson, Cunningham, Legg England, & Hinchy, 1991).

However, these results are not consistent with the findings of Loba et al. (2002) who found that gamblers enjoyed playing the game more and reported finding it more difficult to stop their gambling when games were played at faster speeds. However, Loba et al.'s (2002) study was conducted in the laboratory. It seems likely that in the laboratory fewer cues of gambling will be present and hence the characteristics of the game may be more important in determining whether play

engenders similar feelings to those experienced in the real setting. In our study, players were playing in the real setting, where all other features were held constant. In this study, there was no evidence that slowing down the speed of play would result in changes to player's patterns of gambling.

There was also little evidence to support the efficacy of reconfiguring note acceptors on electronic gaming machines as a harm minimization strategy. Although twice as many probable problem gamblers used higher denomination note acceptors than non-problem gamblers, modified machines did not have an apparent impact on patterns of play. This is perhaps unsurprising since all venues have facilities to change larger denomination notes so that the player can simply insert two $20 and one $10 note, rather than one $50 note. Although representing an inconvenience, the amount that they gamble, the bets they choose to place and the outcome remains unaffected.

The present results do suggest that lowering the maximum bet size would reduce the level of harm associated with gambling. In practice, lowering the maximum bet size means lowering the number of credits that are staked per line. Although only a small proportion of participants in this study bet over the one-dollar maximum bet, the majority of these were probable problem players. Comparing play on the modified machines (one dollar maximum bet) with machines with a $10 maximum bet reduced time spent gambling, number of bets and losses.

In addition, the benefits of reduced cigarette and alcohol use were observed. This latter finding may be an artefact given that participants played for less time on these machines and therefore had less time to consume these substances. However, it may also be associated with the levels of tension that are engendered by higher wagers, that is, as wagers increase, so does subjective levels of tension leading to greater use of nicotine and alcohol to 'settle nerves'. Future research would be needed to clarify these relationships.

In conclusion, to the authors' knowledge, this is the first study to systematically investigate the effects of proposed harm minimisation strategies involving changes to the design of gaming machines in actual gaming settings with a sample of gamblers. The results from this study suggest that reducing the maximum bet size to one dollar by reducing the number of credits wagered per line is likely

to be effective in reducing losses and persistence associated with gambling. While this study was only able to test whether this was a helpful intervention at a universal level, the fact that it was primarily problem players who wagered in excess of one dollar per bet suggests that this intervention may be particularly helpful for those with problems with gambling. However, the other proposed modifications of slowing down the reel spins and reconfiguring bill acceptors to accept only lower denominations were not supported as effective measures.

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