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IDENTIFYING PROBLEM GAMBLERS AT THE GAMBLING VENUE: FINDING COMBINATIONS OF HIGH CONFIDENCE INDICATORS

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Abstract:
The purpose of this research was to identify combinations of behavioural (e.g., long gambling sessions or quitting only at closing time), physiological (e.g., getting the shakes or feeling nauseous) and emotional (e.g., depression or anger) responses to gambling, which could be used to identify problem gamblers with a high degree of confidence. In a survey of 711 regular VLT gamblers in Nova Scotia, respondents self reported the frequency with which they exhibited a list of indicators while gambling. The occurrence of these cues was then weighted by frequency per trip and number of trips to VLT locations per month in order to create a dataset reflective of the frequency of these events in the venues and their association with problem gamblers. Association analysis was then used to derive combinations of two or three cues that would identify problem gamblers with a high degree of confidence. A large number of highly predictive cue combinations were identified. Using cue combinations of up to three cues, with at least one visible cue and confidence values greater than 90%, 86.0% of the problem gamblers could possibly be identified. The average occurrence of "false approaches" would be 6.0%. The research is the first of its kind to provide a methodology and results that indicate that gamblers could be identifiable on site.

Keywords:
problem gamblers, on site identification, association analysis

Introduction

The issue of whether problem gamblers can be recognized "on the floor" is becoming an important one (Allcock 2002). Up to now gambling providers wishing to identify and assist problem gamblers have had to rely primarily on self-identification (Symond 2002). Gamblers who are approached by staff at these venues are referred to the responsible gambling officer who may refer the gambler to a counselor, who screen for problem gambling. As Schaffer et al. (1997) point out however, those gamblers who present themselves for treatment are, in all likelihood, very different from those who do not and a more proactive approach may be needed to identify the majority of problem gamblers who never seek assistance.

At least one program, the Responsible Gaming Program in Nova Scotia encourages servers to identify potential Video Lottery Terminal (VLT) gamblers and refer them to a gambler's helpline. The guidelines for this program were based on preliminary work conducted by Schellinck and Schrans (1998). However, we have not been able to find any publications that have empirically tested the value of specific cues in identifying problem gamblers while they are in the venue.

In a study of frequent non-problem gamblers and problem gamblers in Alberta, Canada (Wynne, Smith & Volberg 1994) it was found that several respondents vacillated between non-problem and problem stages of gambling on their own. Therefore more proactive identification of problem gamblers is needed that is sensitive to the time the behaviours occur.

The purpose of this article is to examine the potential for identification of problem VLT gamblers at a venue based on observable or easily elicited cues that would be manifested by gamblers during one or more visits to a particular location. This research hopes to identify single cues or combinations of cues that when observed lead to a high degree of confidence in the identification of problem gamblers.

The use of these cues, should we identify them, has several advantages over relying solely on screens that are only administered by professionals. These advantages include the following (1) use of the predictive cues could be incorporated into existing or planned on site intervention protocols thus increasing their effectiveness; (2) the ability to react to these cues at the time they are observed will add immediacy to the intervention, that is, the problem gambler may at that time be more willing to agree and act on the assumption that they are gambling at problematic levels; (3) by adopting a protocol to identify problem gamblers, establishments and staff will gain greater insight into the nature of problem gambling at their site; (4) identification of these cues may contribute to the development of self administered screens. In particular, gamblers will be better able to self distinguish these cues while they are gambling; (5) the assessment of these cues (e.g., long sessions and nausea during play) may be useful for identifying problem gamblers in the early stages of problem gambling; (6) these cue combinations, if proven predictive of problem gambling, can potentially be administered by site staff, professionals and by the gamblers themselves; (7) many problem gamblers may welcome intervention on site. In some cases this will verify what the gambler suspects, or believes, and may motivate them to solve the problem. In the end a much higher proportion of gamblers may seek professional help than is the case at present; (8) problem gamblers are likely to be those who repeatedly exhibit these cues, thus providing observers with greater assurance they have identified a problem gambler.

There are also several possible disadvantages to using on site cues to identify problem gamblers: (1) many patrons may not wish to be identified as problem gamblers on site, regardless of the accuracy of the assessment. If staff is rebuffed too often then they will abandon the effort. As well, senior management is unlikely to actively promote interventions if they suspect they are merely driving their customers to the competition; (2) there may be difficulties for staff utilizing the cues to identify problem gamblers, for example, it may be difficult for staff to remember specific combinations of cues, particularly if they happen relatively infrequently. Uncertainty is likely to lead to a lack of will power to act on the assessment. Also, there may be uncertainty as to when a cue is exhibited. For example, staff may have trouble deciding if a gambler is shouting at a machine, or whether they spent more than ¾ of their time gambling while at the venue. The task of eliciting less obvious cues may prove to be difficult for staff. Similarly, some of the cues tested in this paper may occur (e.g., nausea) but go unnoticed by staff as the visible cue in the combination was not seen. They therefore would make no attempt to elicit the less obvious cues and thus identify a problem gambler; (3) the use of cues to identify problem gamblers may have no validity in the eyes of many gamblers and they may refuse to cooperate or act on the intervention. Again, if this happens too frequently

staff may be reluctant to act when they identify a possible problem gambler; (4) the cues that are highly predictive in some venues or locations may be less accurate elsewhere.

Many of these potential disadvantages may be overcome through training of staff and the development of procedures designed to minimize negative reactions or disbelief on the part of gamblers identified. The predictive accuracy of the cues will have to be tested in different venue types and across jurisdictions. If the use of these cues proves more advantageous than not, then interventions could prove to be much more valuable than existing means of identifying problem gamblers.

Selection and Categorization of Cues

The study is based on data collected during a survey of regular EGM players and is therefore based on self reporting of the frequency of occurrence of these behaviours and reactions while gambling. Our selection of cues was thus restricted to those for which information was solicited during the administration of the questionnaire. The purpose of the original survey was to identify behaviours and attitudes associated with problem gambling, and thus it covered a wide range of possible cues. The list presented here is therefore not exhaustive, but it certainly includes a large number that could be useful in identifying problem gamblers on site. We have categorized the cues based on their observability, as this will form the bases for discussion on how to implement any strategy regarding the use of these cues to identify problem gamblers.

The first set of cues is those that a person could readily observe during the gamblers play of the machines. The most easily observed cues measured in the survey are day of the week, time of day, gender of gambler, drinking alcohol while gambling, jamming the machines so that they play continuously, using a credit card or cashing a cheque on site in order to continue gambling, playing to closing time. Also observable are behaviours exhibited during play such as swearing or cursing, cheering or yelling, hitting or kicking the machine. Less easily observed but of similar nature are sighing or groaning or talking to the machine in a threatening or encouraging manner while gambling.

A second set of cues are those that observers might use which require observation over the period of the visit. On a per visit bases they could observe the proportion of time spent at the venue gambling (e.g., ¾ or more of their time at the venue), whether they tend to gamble with friends or gamble alone, whether they stop and resume play several times a day, how long they gamble per session, and whether they borrow money from friends in order to continue gambling.

A third set of cues is not likely to be directly observable, but has the potential value in identifying problem gamblers none-the-less are the psychological cues which in this survey were butterflies in your stomach, dry eyes, heart racing or pounding, nausea or feeling sick to your stomach, headaches, sweaty hands or body and getting the shakes/tremors or trembles while gambling. Emotional responses while gambling measured in this survey were getting excited and feeling happy, nervous or edgy, angry or frustrated, sad or depressed and feeling disappointed.

While some of these may engender visual indicators (e.g., nausea or anger), they are most likely to only be observed if the staff member overhears something said by the gambler or friends, or, in a conversation with the gambler that may elicit a response regarding these effects. Exactly how these cues would be elicited is not discussed here, though it is

believed that these cues could be elicited in a conversation initiated by the observer if other more easily detected cues are first observed (e.g., kicking the machine or using a credit card to obtain cash in order to continue gambling).

These cues may also be particularly appropriate for self-identification. Harm minimization programs may decide not to rely on proactively approaching gamblers exhibiting indicators of problem gambling and may rely instead on providing the gamblers with a list of symptoms of problem gambling in the hopes they will seek assistance. For those who suggest identifying those gamblers in distress and dealing with distress rather than problem gambling, these reactions to gambling, e.g., nausea, dry eyes and feeling sad or depressed when playing could be used as indicators of distress.

The distinguishing characteristic of these cues is that they are observable or can be elicited on site. Some of the variables are directly observable, while others are only distinguishable by the players (e.g., feeling depressed). These latter cues would need to be elicited by an observer if they are to be used as an identifier. All of the cues are derived directly from the behaviours and reactions that surround the play of the machines at the location during a single visit. They therefore do not require the observer to note cues over multiple visits. Other factors that may be associated with problem gambling (e.g., superstitious beliefs) are left to the screens that would be administered by professionals.

The power of these cues to identify problem gamblers will be examined by themselves, and then when they occur in combinations of two and three. Not all combinations will be reported or discussed, as there are over 200,000 possible combinations of these cues three at a time. Instead we will examine cue combinations that are highly predictive of problem gambling and that include at least one easily observable cue in combinations of two or three. This could result in the creation of numerous tables of cue combinations that can identify problem gamblers. We will provide these tables with the intent of providing enough information so that others can utilize the findings to design effective tests of our results in the field.

Method

Video Lottery Player Survey

A random sample of 11,691 households in Nova Scotia, Canada was initially contacted for participation in a household screening survey (Schellinck and Schrans 1998, 2003). Rotational systematic random sampling with a minimum of three passes through the telephone company listings was used to generate a sampling frame. The telephone company estimates that approximately 1.85% of residential telephone numbers in Nova Scotia are unlisted and that 97% of adults can be reached by telephone (source: MT&T, 1998). The household screen consisted of a brief survey that identified the total number of adults (19+ years) in the household and the frequency and recency of video lottery gambling for each adult. Of the 11,691 households sampled, a total of 9,339 households (79.9% of households) and 18,650 adults were successfully screened, yielding a response rate of 79.9% for the household screen. Within this sample, 927 regular VLT players were identified and 711 (76.7% of all those qualified) completed the VLT players' survey. The overall response rate for the survey was 61.3%. Data collection lasted from October 12, 1997 to January 19, 1998.

Identification of problem gamblers

There is considerable controversy regarding the effectiveness of the SOGS for use with non-clinical populations (Volberg, 1996; Walker & Dickerson, 1996; Schaffer et al., 1999; Ladoucer et al, 2000). For these reasons the Nova Scotia Department of Health requested Focal Research develop a new measure of problem gambling which was subsequently used to identify problem gamblers (Schellinck & Schrans, 1998).

The Focal Gambling Screen (FGS) has subsequently been used in several studies (Schellinck Schrans & Walsh, 2000; Schellinck & Schrans 2002) and has proven to be both reliable and to have considerable convergent validity with other measures of problem gambling. In three separate surveys the measure has achieved Cronbach's Alpha of .89 (n=711 regular gamblers), .88 (n=221 regular gamblers, Schellinck & Schrans, 2002), .82 (n=181 mixed sample of non-gamblers, past gamblers and present regular gamblers, Schellinck Schrans & Walsh, 2000). In these same studies the DSM IV (Lesieur and Blume 1987) had an Alpha of .83 (n=181) and the Canadian Problem Gambling Index (Ferris & Wynne 2001) had an Alpha of .87 (n=221). The Kappa with the DSM IV (last year) was .62 and with the CPGI was .58. In the study where the modified (to measure the impact of VLT gambling only) DMS IV was used, it classified 22% of the sample as problem gamblers compared to 25% for the FGS. In the study where the CPGI was used the CPGI classified 38% of respondents as moderate risk or problem gamblers compared to a 35% classification of problem gamblers for the FGS.

In terms of construct validity the measure has been shown to be highly correlated with those characteristics traditionally shown to be associated with problem gambling, including expenditure, frequency of play, superstitious behaviours while playing and chasing of losses (Schellinck & Schrans, 1998).

Analysis

The analysis technique used was association analysis. This analysis technique is commonly used in data mining to determine the association rules for events in a specific time frame, such as a visit to a store, or in this case, a location where VLT's are played (Piatesky-Shapiro 1991, Han and Fu 1999, MacDougall M., 2003). These primary measures are generated by the analysis of each combination of events (cues) that occur along with the target event, in this case a problem or non-problem gambler visiting an establishment to gamble. There are three measures traditionally reported with this analysis:

1. Confidence, which is the probability the person is a problem gambler given the occurrence of these events during a visit. If confidence is 90% then there is a 90% chance the person is a problem gambler and a 10% chance of a false positive assessment.

2. Support, the percent of total sessions for both problem and non-problem gamblers in which this combination of events occurs. For example, a confidence of 4% means that we can expect this combination of cues to occur in 4% of the trips made to a venue by gamblers. The greater the support, the more likely a cue combination will be noticed at the site. If confidence is also high then this will be a useful cue combination for identifying problem gamblers.

3. The third statistic produced is lift, the increase in confidence (that a player is a problem gambler) due to the combination of events occurring during a session. A lift of 1.00 means that observing the set of cues does not help us at all in identifying problem gamblers, while a lift of 3.00 means that a gambler exhibiting these cues is three times more likely to a be problem gambler than normal.

As well, the size of the sample (n) that indicated the events in combination occurred to them during a at least one gambling visit is reported. The estimates of confidence, support and lift are based on the weighted counts of event combinations derived from those gambler cases. However, problem gamblers more frequently exhibit these behaviours or reactions to gambling and thus, when the data is weighted they contribute considerably more event combinations used to derive the statistics. There is no direct measure that can be used to derive confidence estimates around the measures and the n's are supplied to provide a judgment as to the reliability of the reported figures.

The potential value of identifying problem gamblers was assessed using four measures. First, the average confidence measure weighted by frequency of event combination (count) with over 90% confidence value is reported to provide an overall measure of confidence for the approach. Second, the percent of problem gamblers and the percent of non-problem gamblers who ever exhibit these combination of cues was calculated to estimate the potential reach of the approach in identifying the problem gambler population, and incorrectly approaching non-problem gamblers. The third statistic produced estimated the percent of those who might be approached that would be problem or non-problem gamblers.

We hypothesize that those non-problem gamblers approached will be more likely to be at risk of problem gambling. Therefore a final analysis compared those non-problem gamblers who might be approached (false approaches) to those who wouldn't be approached to determine if they are significantly higher on two measures of problem gambling found in the Focal Gambling Screen. The first is a ten-point scale of self-designation of problem gambling and the second is a measure based on the summation of six, five point scales producing a range from 6 to 30 (Alpha = .86).

The following cues were examined as to their potential value in identifying problem gamblers on the site: those who gamble on the machines until closing time; gambling alone or with others, drinking alcoholic beverages while gambling; playing two or more machines at the same time; jamming the machines so that they play continuously; returning the same day to play more than once at a location; how often they obtain cash to continue gambling by borrowing, credit card or cashing a cheque; visible behaviours such as kicking or hitting the machine, swearing or cursing, yelling or cheering, sighing or groaning, or talking to the machine; complaining about physiological reactions to gambling including feeling sick to their stomach or nauseous, butterflies in the stomach, dry eyes, heart racing/pounding, headaches, sweaty hands or body and the shakes/tremors/trembles; or stating an emotional response such as feeling excited/happy, nervous/edgy, angry/frustrated, sad or depressed, disappointed.

For these variables the question was asked how often the respondent (behaved in that way or had that reaction) when they were playing VLTs (proportion scale). The response to these measures was a five-point scale of never (0%), rarely (<25%), occasionally (25% to 50%), frequently (50% +) and almost always (≈100%). The data was weighted for analysis by assigning a value of 0, 1, 3, 6 and 8 for the midpoints of these ranges, 0%, 12.5%,

37.5%, 75% and 100%. Thus a person who said they borrowed money occasionally would be weighted 3 for that cue and it would appear in 3 out of the 8 weighted visits.

There were two alternatives for assigning cues to the weighted visits. The first approach simply assigned the cues to the first and subsequent visits. Thus, the person who borrowed money occasionally would have the cue assigned to the first three weighted visits. If they also frequently talked to the machine this cue would be assigned to the first six weighted visits. This process arbitrarily bunched the cues together, so that the first visit contained all the cues a person said they ever exhibited and usually the last visits had no cues. This may be a reasonable scenario if it is assumed that these reactions to gambling tend to occur together (e.g., swearing, kicking the machine and then borrowing money from others). However, arbitrarily bunching cues may over state degree of "support" for combinations of cues (e.g., how often the gambler cheers and talks to machine in the same visit).

The alternative was to assign the cues in random order to the weighted visits. Thus, the person who borrows money occasionally might have this cue appearing in the second, fifth and sixth visits. This will lead to lower support levels for the larger combination of cues as there is a reduced chance that three or more cues will be assigned to the same visit. This was viewed as the more conservative approach, but the reliability of the results using random assignment needed to be determined before we could adopt this approach. We generated ten datasets using random assignment of the cues to visits. Those correlations of confidence and support of 1157 cue combinations that were in common with all ten datasets (ten two cue combinations and 52 three cue combinations had support levels too low in at least one of the datasets and were therefore excluded from the analysis) were calculated to determine the stability of the results given random assignment of the cues. The 45 resulting correlations averaged 1.00 for the confidence and lift levels (as lift is derived from confidence) and between .994 and .996 for the support levels. Given the virtually identical results among the ten datasets we selected the first random dataset for data analysis. However, cue combinations that did not find sufficient support in all of the ten datasets were excluded from the tables.

Other variables that might be useful for this purpose such as day of week and time of day that gambling occurs were not easily combined to a format that would allow them to be analyzed using association analysis and therefore were excluded from this particular analysis.

The degree to which problem gamblers, compared to non-problem gamblers, exhibited the cues was also weighted by the average number of trips the gambler made to VLT locations in the previous four months. This was necessary as, from the venue observer's point of view, a gambler who visits one establishment once a month will have the same frequency of visits to the observer's venue as a gambler who visits four establishments once a month. The trips to locations variable was derived based on the number of trips they took to gambling locations divided by the number of locations they regularly visited (or the number they occasionally visited if they had no regular locations). It was necessary to use four months (120 days) as many gamblers visit a particular location less than once a month, and for some the number was as low a once every four months. Selecting only one month would arbitrarily increase the frequency of visits of these gamblers so that they could receive a weighting of one visit per month when a weighting of ¼ would have been more accurate. The number of visits per respondent after taking into account both weighting factors therefore ranged from 8 to 960.

Results

The problem gamblers, who comprise 16.5% of the sample, made 26.6% of the visits to VLT locations. Only when problem gamblers exhibited a cue more than the expected 26.6% was it chosen for inclusion in the association analysis. Based on preliminary analysis we dropped the following variables: gambling alone or with others, returning the same day to play more than once at a location; feeling excited/happy, and gender. The time of day and day of week that gamblers play the machines could not be entered into the analysis as these cues must be exclusive and we were not able to devise a way of introducing them into the analysis using random assignment.

Table 1:
Single Cue Prediction of Problem Gambler Visits

Cue Combinations	*CONF*	*SUPPORT*	*% PG visits*	*LIFT*	*n*
Feel sick to stomach/nauseous	78.59	4.45	16.72%	2.95	81
Feel sad/depressed	74.50	7.74	29.08%	2.80	155
Over 180 minutes	66.91	9.67	36.34%	2.51	80
Borrow money	63.68	2.32	8.72%	2.39	69
Shakes	63.00	1.32	4.97%	2.37	36
Sweaty palms/body	62.85	6.67	25.05%	2.36	133
Feels edgy/nervous	62.53	6.05	22.72%	2.35	158
Headache	60.85	6.90	25.94%	2.29	130
Gets cash	58.67	2.11	7.93%	2.21	127
Over 120 minutes	54.28	13.72	51.54%	2.04	179
3/4 of time gambling	54.00	19.96	75.02%	2.03	197
Credit card	53.64	0.67	2.52%	2.02	13
2 VLTs at same time	53.03	2.70	10.16%	1.99	96
Feels angry	52.83	8.61	32.36%	1.99	283
Dry eyes	52.31	4.39	16.49%	1.97	144
Heart racing	51.89	4.57	17.18%	1.95	196
Quits at closing	51.74	6.61	24.83%	1.94	209
Cash cheque	51.57	0.90	3.40%	1.94	25
Groan	50.75	10.84	40.73%	1.91	319
Jam machine for continuous play	46.89	3.61	13.55%	1.76	132
Butterflies	44.06	4.11	15.45%	1.66	219
Swear	39.97	8.72	32.79%	1.50	308
Talk to the machine		7.09	26.65%	1.48	282
Kick the machine	37.57	1.81	6.79%	1.41	88
Cheer	34.30	4.48	16.84%	1.29	267
Drink alcohol	26.61	8.56	32.18%	0.99	525

Table 1 presents those cues that had a lift greater than 1.00 and thus by themselves have an ability to help identify problem gamblers. The consumption of alcohol during play (lift 0.99) was also kept in the analysis given its high observability and its importance as a subject of research in the problem gambling literature.

Gamblers who feel sick to their stomach or become nauseous are most likely (78.6%) to be problem gamblers if a single cue is used. The likelihood of any visiting gambler being a

problem gambler is 26.6% and this is the benchmark against which the power of the cues to identify problem gamblers is judged. The lift for the cue nausea is 2.95, or an increase of 195% over the benchmark of 26.6%. Gamblers feel nausea while playing during 4.4% of the visits of all gamblers (support) and in 16.7% of visits made by problem gamblers.

The only other cue with a confidence level over 70% is the gamblers feeling sad or depressed while playing (not to be confused with clinical depression), with a confidence of 74.5% and a relatively high support of 7.7% for all gamblers and an occurrence rate of 29.1% for problem gamblers. There are six cues with a confidence level between 60% and 69%. The next two cues are more observable cues. Those who gamble on the machines for three or more hours at a time have a likelihood of 66.9% of being a problem gambler and this happens relatively frequently with a support of 9.7% for all gambler visits and 40% of problem gambler visits. Similarly, if a gambler borrows money in order to continue gambling then the confidence level is 63.7%, the support is 2.3% of gambler visits and 8.7% of problem gambler visits. The other four cues with confidence levels above 60% are physiological responses while playing the machines; getting the shakes or trembles, sweaty hands or body, feeling nervous or edgy, and getting a headache. These four cues may sometimes have observable elements.

Another eleven cues have confidence levels ranging from 50 to 59%. The first six of these cues have the advantage of being observable. They are: getting cash to continue gambling, gambling for more than two hours at a time, spending over ¾ of their time at the venue gambling, using their credit card to obtain more cash to gamble and playing two machines at the same time. These cues are of little value in themselves, but may become important as identifiers when combined with other cues.

Table 2 presents the nine cue combinations out of 279 possible two-way combinations of observable cues that had confidence values greater than 80%. As might be expected, those combinations of cues that are the best predictors tend to be relatively uncommon (low support). At the top of the table are those visits where the gamblers play for at least two hours and use a credit card to continue gambling. In these situations an estimated 99.3% are problem gamblers. However, this happens very rarely with support at 0.39%, and in 1.45% of problem gambler visits. It should be noted that, at the time of the study few of the establishments allowed gamblers to obtain cash using their credit card. For those who did allow this practice, the support levels would be much higher, as would be the percentage of gamblers visits where this happens.

Table 2:
Combinations of Two Visible Cues, Which Predict Problem Gambler Visits

Cue Combinations	*CONF*	*SUPPORT*	*% PG visits*	*LIFT*	*n*
Over 180 minutes & Cash cheque	90.9	0.56	2.11%	3.42	11
Over 120 minutes & Cash cheque	87.7	0.60	2.25%	3.30	15
Over 180 minutes & Jam machine for continuous play	85.8	1.43	5.39%	3.23	24
Over 180 minutes & Kick the machine	84.6	0.71	2.68%	3.16	19
Over 180 minutes & Borrow money	82.8	1.14	4.29%	3.11	19
Quits at closing & Borrow money	82.5	0.82	3.07%	3.10	41
Over 120 minutes & Borrow money	81.9	1.43	5.39%	3.08	38
Gets cash & Groan	80.0	0.99	3.71%	3.01	83

Of the eight cue combinations in the table, four combine cues related to the length of session and obtaining more money to continue gambling by cashing a cheque or borrowing money. Two others also involve obtaining cash to continue gambling, borrowing cash and gambling till closing time and obtaining cash by any means and sighing or groaning while gambling. The remaining two combinations include length of session, but include visible behaviours related to play, either jamming the machine to allow for continuous play or hitting/kicking the machine.

Table 3:
Combinations of Two Cues, One Visible, Which Predict Problem Gambler Visits

	One visible and one elicited cue				
Cue Combinations	*CONF*	*SUPPORT*	*% PG visits*	*LIFT*	*n*
Cash cheque & Feel sick to stomach/nauseous	99.0	0.44	1.65%	3.72	9
Feel sick to stomach/nauseous & 2 VLTs at same time	95.8	0.37	1.37%	3.60	35
Over 120 minutes & Shakes	95.6	1.01	3.79%	3.58	20
Jam machine for continuous play & Feel sick to stomach/nauseous	94.9	0.54	2.04%	3.57	28
Cash cheque & Headache	94.8	0.60	2.27%	3.56	12
Quits at closing & Feel sick to stomach/nauseous	92.6	1.22	4.57%	3.48	45
Borrow money & Feel sick to stomach/nauseous	91.0	0.64	2.41%	3.42	26
Jam machine for continuous play & Dry eyes	90.6	0.87	3.25%	3.41	37
Over 180 minutes & Headache	90.2	3.04	11.41%	3.39	32
Talk to the machine & Feel sick to stomach/nauseous	89.9	1.27	4.77%	3.38	54
Quits at closing & Feel sad/depressed	88.9	1.92	7.20%	3.34	91
Gets cash & Feel sick to stomach/nauseous	88.0	0.50	1.86%	3.31	36
Cheer & Feel sick to stomach/nauseous	87.8	0.79	2.97%	3.30	50

Table 3 presents the cue combinations with one visible cue and one to be elicited that have a confidence value of 90% or greater. With the exception of the cue playing two or more VLTs machines simultaneously, all of the visible cues in this table were present in table 2. Now they have been combined with three physiological cues: feeling sick/nauseous while gambling, getting the shakes/trembles while gambling, and getting dry eyes.

Out of 949 three-way combinations of cues that predict problem gambler visits there were 192 that had confidence levels of 90% or better and contained at least one visible cue (there were another 29 cue combinations with confidence levels greater than 90% that did not contain a visible cue). Table 4 presents those cue combinations with three visible cues and confidence values greater than 90%. Length of session cues occur in six of the ten combinations. Two new cues feature in the table, gambling for ¾ of the time or more that the gambler is in the venue in seven of the combinations, and swearing at the machines while gambling in two others. In every combination, keeping track of the gambler either in terms of length of session or proportion of time spent at the venue gambling plays a part.

Table 4:
Combinations of Three Visible Cues, Which Predict Problem Gambler Visits

	Three visible cues				
Cue Combinations	*CONF*	*SUPPORT*	*% PG visits*	*LIFT*	*n*
Over 180 minutes & Jam machine for continuous play & 3/4 of time gambling	94.6	0.99	3.71%	3.56	17
Over 180 minutes & Kick the machine & 3/4 of time gambling	93.4	0.70	2.62%	3.51	15
Swear & Over 120 minutes & 2 VLTs at same time	92.9	0.67	2.50%	3.49	30
Swear & Jam machine for continuous play & 3/4 of time gambling	92.2	1.03	3.86%	3.47	34
Quits at closing & Over 180 minutes & Jam machine for continuous play	91.8	0.45	1.69%	3.45	18
Jam machine for continuous play & Groan & 3/4 of time gambling	91.2	1.23	4.60%	3.43	36
Gets cash & Groan & 3/4 of time gambling	91.1	0.82	3.07%	3.43	58
Quits at closing & Jam machine for continuous play & 3/4 of time gambling	90.7	0.79	2.97%	3.41	27
Over 120 minutes & Cash cheque & 3/4 of time gambling	90.5	0.56	2.12%	3.40	12
Over 120 minutes & Groan & 2 VLTs at same time	90.0	0.56	2.10%	3.38	31

Table 5 presents the top 20 combinations with two visible cues in the combination. Where three hour and two hour sessions ranked near to each other in the table the combinations containing the three-hour event were deleted from the table. The cue combinations in this table have very high confidence levels (96.55% or higher) though the support levels range from 0.37% to 1.20% of all visits. Three new cues appear in the table: talking to the machine in an encouraging or threatening manner appears in two combinations, feeling sad or depressed while gambling in another two, and heart racing/pounding in one combination. The top three combinations have small sample sizes (8-9) but all have confidence levels of 100%, suggesting reasonable validity/reliability.

Table 5:
Combinations of Three Cues, Two Which are Visible,
Which Predict Problem Gambler Visits

	two visible cues and one elicited				
Cue Combinations	*CONF*	*SUPPORT*	*% PG visits*	*LIFT*	*n*
Over 120 minutes & Headache & Cash cheque	100.00	0.38	1.42%	3.76	8
Headache & Cash cheque & 3/4 of time gambling	100.00	0.57	2.13%	3.76	9
Feel sick to stomach/nauseous & Cash cheque & 3/4 of time gambling	100.00	0.44	1.65%	3.76	8
Sweaty palms/body & Jam machine for continuous play & 3/4 of time gambling	99.78	0.66	2.49%	3.75	19
Groan & Dry eyes & 2 VLTs at same time	99.68	0.45	1.69%	3.75	32
Over 120 minutes & Feel sick to stomach/nauseous & Borrow money	99.30	0.41	1.55%	3.73	14
Jam machine for continuous play & Groan & Dry eyes	99.00	0.43	1.61%	3.72	29
Talk to the machine & Jam machine for continuous play & Dry eyes	98.84	0.37	1.39%	3.71	28
Feel sad/depressed & Over 120 minutes & 2 VLTs at same time	98.29	0.42	1.56%	3.69	30
Talk to the machine & Shakes & Over 120 minutes	97.75	0.38	1.42%	3.67	17
Feel sad/depressed & Groan & 2 VLTs at same time	97.69	0.49	1.84%	3.67	39
Jam machine for continuous play & Feel sick to stomach/nauseous & 3/4 of time gambling	97.57	0.52	1.96%	3.67	21
Over 120 minutes & Feel sick to stomach/nauseous & Drink alcohol	97.40	0.54	2.03%	3.66	31
Shakes & Over 120 minutes & 3/4 of time gambling	97.38	0.91	3.43%	3.66	16
Headache & Groan & 2 VLTs at same time	97.26	0.56	2.12%	3.66	32
Jam machine for continuous play & Heart racing & 3/4 of time gambling	97.23	0.46	1.72%	3.65	26
Over 120 minutes & Headache & Borrow money	97.21	0.50	1.90%	3.65	17
Quits at closing & Feel sick to stomach/nauseous & 3/4 of time gambling	96.86	1.20	4.52%	3.64	34
Feel sad/depressed & Jam machine for continuous play & 3/4 of time gambling	96.74	1.07	4.03%	3.64	30
Gets cash & Feel sick to stomach/nauseous & 3/4 of time gambling	96.55	0.49	1.82%	3.63	37

Table 6 presents those cue combinations that contain one visible cue and two that must be elicited. All combinations have a confidence value of 96.77% or higher, with support ranging from 0.37% to 1.79%. The sample sizes, ranging from 17 to 44, are larger than others with three way combinations as more of the gamblers manifest non-observable reactions to gambling than those that are visible. Two new cues appear in the table: being nervous/edgy during play, and getting angry during play.

Table 6:
Combinations of Three Cues, One Visible, Which Predict Problem Gambler Visits

	one visible cues and two elicited				
Cue Combinations	*CONF*	*SUPPORT*	*% PG visits*	*LIFT*	*n*
Headache & Dry eyes & 2 VLTs at same time	99.63	0.39	1.45%	3.74	28
Shakes & Over 120 minutes & Headache	98.96	0.55	2.07%	3.72	18
Shakes & Over 120 minutes & Feels edgy/nervous	98.50	0.38	1.43%	3.70	19
Shakes & Over 120 minutes & Feel sick to stomach/nauseous	98.37	0.43	1.63%	3.70	17
Talk to the machine & Feel sad/depressed & Feel sick to stomach/nauseous	98.28	0.58	2.18%	3.69	44
Shakes & Feel sick to stomach/nauseous & 3/4 of time gambling	98.22	0.56	2.10%	3.69	20
Over 120 minutes & Headache & Feel sick to stomach/nauseous	98.21	1.27	4.78%	3.69	37
Jam machine for continuous play & Headache & Dry eyes	98.18	0.39	1.47%	3.69	23
Dry eyes & Angry & 2 VLTs at same time	98.06	0.37	1.37%	3.69	36
Shakes & Feel sad/depressed & Over 120 minutes	97.95	0.41	1.56%	3.68	20
Headache & Feel sick to stomach/nauseous & 3/4 of time gambling	97.94	1.79	6.72%	3.68	39
Over 120 minutes & Headache & Feels edgy/nervous	97.74	1.38	5.17%	3.67	41
Sweaty palms/body & Over 120 minutes & Headache	97.59	1.05	3.96%	3.67	33
Shakes & Headache & 3/4 of time gambling	97.57	0.64	2.39%	3.67	20
Quits at closing & Feel sad/depressed & Feel sick to stomach/nauseous	97.29	0.47	1.75%	3.66	39
Quits at closing & Sweaty palms/body & Headache	97.19	0.45	1.69%	3.65	32
Sweaty palms/body & Headache & 3/4 of time gambling	97.04	1.09	4.09%	3.65	35
Jam machine for continuous play & Dry eyes & Angry	96.90	0.41	1.53%	3.64	34
Shakes & Over 120 minutes & Angry	96.80	0.39	1.48%	3.64	20
Feel sad/depressed & Over 180 minutes & Headache	96.77	1.17	4.39%	3.64	27

The potential practical value of using this approach was assessed by determining the average confidence value weighted by visits for the 204 two and three cue combinations with confidence values of 90% or greater. This was 94.0%, which says that in 6.0% of the cases when a gambler manifests these cue combinations they are not a problem gambler. An estimated 86.3% of problem gamblers experienced at least one combination of these cues while 20.7% of non-problem gamblers also experienced these events in combination (corrected chi-square = 192.004, p = 0.000). Though non-problem gamblers account for 6.0% of the occurrence of the cue combinations during gambling sessions (in the venue), they make up 54.9% of those gamblers who ever exhibit these cue combinations. (This would suggest that possible interveners should witness multiple combinations of events by a gambler to be relatively certain they are a problem gambler.)

The sample of those who would be approached but would not be problem gamblers (false approaches) were compared to those who would not be approached on two of the three Focal Gambling Screen measures used to identify problem gamblers. On a ten-point scale where gamblers rated their current gambling in terms of the degree to which they feel it is a problem, with one indicating no problem at all and ten indicating a serious problem, the false approaches scored 2.12 (n = 123, SD = 1.35) compared to 1.35 (n = 471, SD = 0.84) for the other non-problem gamblers (t= 6.02, p = 0.000). Only 48.0% of the false approaches selected the lowest point on the scale compared to 80.5% of the other non-problem gamblers. On the six-item measure with scores indicating problem gambling ranging from a low of 6 to a high of 30, the false approaches scored an average of 10.15 (n = 123, SD = 3.57) while the average was 7.27 (n = 471, SD = 2.28) for the other non-problem gamblers (t = 8.48, p = 0.000). In this case 17.9% of the false approaches scored the lowest possible value compared to 63.3% of the other non-problem gamblers.

Discussion

The purpose of this analysis was to determine whether combinations of cues that are observable, or could be elicited, could be useful for identifying gamblers who have a high probability of being problem gamblers. It was found that both a wide range of visible and non-visible cues, when occurring in combination during a visit have high confidence value (i.e., 90% or better) in classifying somebody as a problem gambler. While the occurrence for these individual combinations is low, the list of combinations if taken together provides the potential for identifying 86.3% of problem gamblers. The average false identification level per visit is only 6.0% for the top 204 combinations with 90% confidence or better and at least one visible cue, but the percent of those who could be falsely identified is 20.7% and these people could possibly make up as many as 54.9% of those who exhibit these combinations of cues. However, those non-problem gamblers are at a higher risk of problem gambling.

The cues found in the combinations with the highest confidence are those that have been listed by others as most likely to identify problem gamblers (Allcock 2002) including attempts to obtain cash through the use of credit cards, cashing cheques or borrowing from friends; signs of agitation and disorderly behaviour such as hitting the machine, long gambling sessions, last out at closing time, playing two machines at one time. Other indicators identified in that report, but not studied here include family members seeking out an individual, children left unattended, rushing when leaving a machine, staying after friends leave and the number of session per month. While our analysis did not include a

direct examination of the effect of intoxication, it found no (or very little) relationship between the consumption of alcohol while gambling and problem gambling.

Other cues in combination found to be useful predictors included the physiological reactions to gambling on the machines including feeling sick or nauseous, getting the shakes or trembles, getting headaches, and dry eyes. Emotional responses such as feeling sad or depressed while playing, or feeling nervous or edgy or feeling angry, were associated with problem gambling when found in combination with other cues. Feeling disappointed did not distinguish problem gamblers from non-problem gamblers, and feeling excited and happy was associated with non-problem gambler visits. Vocalizations such as groaning or sighing, talking to the machine in a threatening or encouraging manner and swearing at the machine were associated with problem gambling while cheering, even in combination with other cues, was rarely associated with problem gambling. Finally, spending over ¾ of the time at a venue on the machines, again when combined with other cues, can be an effective indicator of a problem gambler visit.

The point has been made repeatedly that both problem and non-problem gamblers can exhibit these indicators but that this is simply a normal outcome of the gambling experience (Allcock 2002). This analysis confirms that for single cues and for many combinations of cues, roughly half of those exhibiting the indicator are likely to not be problem gamblers. When cues are combined the ability to accurately identify problem gamblers (confidence) goes up dramatically. For example, the single cue of playing for 2 hours or longer has a confidence value of 54.3% and a support of 13.7% with problem gamblers doing this in 51.5% of their visits. When playing for 2 or more hours is combined with borrowing money from friends the ability to correctly identify problem gamblers jumps to 81.9% and the frequency with which the cue combination occurs (support) drops to 1.4%. When a third cue is added, getting a headache while playing on those visits where they gamble for more than two hours and borrow money, the confidence goes up to 97.2% while the support drops down to 0.5% with problem gamblers exhibiting these indicators during 1.9% of their visits. The weigh-off is clear, greater confidence but lower frequency of occurrence.

There are good combinations of cues but individually they will rarely be seen or manifested in that combination. In order to use the results of this research the cue combinations would need to be organized so that high confidence combinations start with primary cues that are mostly likely to be observed, then ranked in terms of the second set and finally the third set. The reach achievable with sets of cue combinations could be calculated and then other combinations with other cues as primary indicators could be identified that substantially improve the reach of problem gamblers (while maintaining high confidence levels). This level of analysis would be conducted in conjunction with staff to determine the most useful cue combinations and is beyond the scope of this paper. It should be noted that any implementation of a scheme to identify problem gamblers should go through a similar process before implementation, assuming they had the information available.

The use of these cue combinations could have a major impact on our ability to identify and help problem gamblers. A harm minimization approach suggests we wish to identify people who are problem gamblers or are at risk of becoming problem gamblers. Research by Schellinck and Schrans (2000) found that there are a large number of gamblers who gamble at problematic levels but have yet to feel the harm of their gambling as they haven't yet gone into debt in order to pay for their behaviour. These people would rarely

seek help for their problem at this stage, yet they are headed down the road toward the point where there could be very harmful effects. Both the venue operators and the gamblers' friends and family would want these people identified and encouraged to gamble responsibly or seek assistance before they get into trouble.

That same study found that the majority of those who have ever sought formal help and thus self-identified themselves as problem gamblers, continue to gamble. These people, if tentatively identified using a combination of cues can be targeted for a self-exclusion program or some other means of help that they may not yet have considered.

Identifying gamblers in the venue using this approach is likely to complement existing measures that have been designed for administration by a specialist for those gamblers who present themselves for treatment. Few problem gamblers present themselves for treatment, and as was indicated in Schellinck and Schrans (2000) many do not fit the profile of people who do. There is a real need then for an alternative way of identifying those who are likely to be now, or in the future, suffering harmful effects due to VLT gambling. It should also be noted that reliance on observational studies would not have uncovered the cue combinations identified in this survey. A survey is therefore a necessary step determine the potential value of physiological and emotional responses while gambling.

This analysis is based on the behaviours of a sample of regular VLT gamblers in Nova Scotia where five to ten machines are available in most bars and pubs. These results are therefore most representative of those who gamble on egms in these types of locations. Similar analysis will need to be conducted with a sample of casino gamblers before conclusions can be made concerning the efficacy of the approach in this type of venue. We have not proven that problem gamblers can be identified on the floor. We have shown that there is a good chance they can be, but that much work needs to be conducted on how to implement an identification strategy, whether based on observer intervention, self identification or distress intervention, and the effectiveness of these approaches tested on site.

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