# Risk communication improvements for gambling: House-edge information and volatility statements

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Abstract:

Objective: Some gambling product messages are designed to inform gamblers about the long-run cost of gambling, e.g., "this game has an average percentage payout of 90%." This message is in the "return-to-player" format and is meant to convey that for every £100 bet about £90 will be paid out in prizes. Some previous research has found that restating this information in the "house-edge" format, e.g., "this game keeps 10% of all money bet on average", is better understood by gamblers and reduces gamblers' perceived chances of winning. Here we additionally test another potential risk communication improvement: a "volatility statement" highlighting that return-to-player and house-edge percentages are long-run statistical averages, which may not be experienced in any short period of gambling.

Method: Gambling information format and volatility statement presence were manipulated in an online experiment involving 2,025 UK gamblers.

Results: The house-edge format and the presence of volatility statements both additively reduced gamblers' perceived chances of winning. In terms of gamblers' understanding, house-edge messages were understood the best, but no consistent effect of volatility statements was observed.

Conclusions: The return-to-player gambling messages in current widespread use can be improved by switching to the house-edge format and via the addition of a volatility statement.

Keywords: consumer protection, electronic gambling machines, house-edge, return-to-player, warning messages

Public health significance statement: Product messages are used in gambling, as well as other public health domains, as a way of informing consumers about relevant product risks. This paper shows that current gambling product messages about the long-run cost of gambling can be improved by switching both the format of the message (from the “return-to-player” to the “house-edge”) and by adding further information about the statistical volatility of gambling.

Product messages can help consumers make informed choices when choosing between products with the potential to cause addiction, such as standard drink or alcohol-by-volume information on alcohol products (Blackwell, Drax, Attwood, Munafò, & Maynard, 2018; Hobin et al., 2017). Product messages are often similarly applied to gambling products as a freedom-preserving way of informing gamblers about the potential risks of gambling (Eggert, 2004; McGivern, Hussain, Lipka, & Stupple, 2019; Monaghan & Blaszczynski, 2009; Newall, Walasek, Singmann, & Ludvig, 2019; Palmer du Preez, Landon, Bellringer, Garrett, & Abbott, 2016). The present research focuses on messages about the long-run cost of gambling on electronic gambling machines (EGMs) and in online gambling. On EGMs, the long-run cost of gambling can be calculated (Harrigan & Dixon, 2009; Woolley, Livingstone, Harrigan, & Rintoul, 2013) and, in some jurisdictions, is communicated to gamblers via a product message. In the UK such a message might be phrased as, "this game has an average percentage payout of 90%" (Collins, Green, d'Ardenne, Wardle, & Williams, 2014). This information means that in the statistical long-run, for every £100 bet, on average £90 is paid-out in prizes. This message illustrates two features that the present research investigates. The first feature is that the information mentions the cost of play indirectly, by highlighting the average payout ("return-to-player") rather than the average amount kept by the house ("house-edge"). Second, this information only conveys the long-run average return and does not mention the volatility of returns that may be experienced in any short period of gambling.

Across the world, many gamblers fail to properly understand what the return-to-player percentage means (Beresford & Blaszczynski, 2019; Collins et al., 2014; Harrigan, Brown, & Barton, 2017; Monaghan, Blaszczynski, & Nower, 2009). Some previous research has investigated effects of restating return-to-player information in the equivalent "house-edge" format (Newall, Walasek, & Ludvig, 2020a). For example, the same information could be presented in house-edge form as, "this game keeps 10% of all money bet on average." Newall

and colleagues found that 66.5% of gamblers correctly understood the house-edge message, compared to 45.6% of gamblers given the equivalent return-to-player message. That study also found that gamblers perceived a lower chance of winning with house-edge than return-to-player information. Taken together, these findings imply that switching from the return-to-player to the house-edge format may make gamblers better informed and warier of the long-run cost of gambling.

In a recent Australian court case, the applicant argued that return-to-player information is misleading because it implies that gamblers will get those returns (Federal Court of Australia, 2018). The judge in that case ruled that return-to-player information is not misleading, but that it is confusing, as it also fails to highlight the potential for statistical volatility. A potential solution brought about by that case is to make return-to-player messages more descriptive, by adding a volatility statement that the relevant statistic is a long-run average which will not necessarily apply in any period of gambling (in about two sentences). A recent study using a sample of Australian consumers found that return-to-player information plus a volatility statement was understood correctly by 63.5% of participants, compared to 52.9% given standalone return-to-player information (Newall, Walasek, & Ludvig, 2020b). House-edge information was still understood the best by 79.9% of participants. The volatility statement did, however, have a large effect on gamblers' perceived chances of winning, driving the average response down to an average of 2.74 on a 7-point scale, compared to 3.75 in the house-edge condition and 3.99 in the standalone return-to-player condition. That study however, did not investigate the potential effects of adding volatility statements to house-edge messages.

The present study is an experiment investigating the effects of product message format (return-to-player, house-edge) and volatility statement presence (absent, present) on gamblers' levels of objective understanding and perceived chances of winning. Based on

previous research, we hypothesized that both changes to standalone return-to-player messages (house-edge format and volatility statement presence) would lead to an increase in levels of objective understanding. We also hypothesized that both changes would furthermore be associated with decreases in participants' perceived chances of winning. Both of these outcomes are arguably desirable features for effective gambling product messages. Varying both features at the same time also allowed this study to test for potential interaction effects between message format and volatility statement presence.

## Method

This study was preregistered. The preregistration document, materials, analysis script, and data are available (Newall, 2020). The study received ethical approval from the University of Warwick's Human Research Ethics Committee (HSSREC).

### Participants

In total, 2,203 UK nationals were recruited to take part in the study on the crowdsourcing platform Prolific Academic. A test of gambling product messages is most relevant to current gamblers, so the inclusion/exclusion criteria were met via two steps. First, participants were eligible to take part in the study if they had indicated in their Prolific profile that they gamble online. More specifically, participants eligible for this study had to answer the question of "What types of online gambling / casino games have you played? Choose all that apply." with one or more of the following types of games: baccarat, craps, roulette, slots, video poker, virtual sports betting. Second, 178 participants who completed the experiment were excluded from the statistical analysis (as preregistered) for self-reporting that they had not gambled in the past year (thus revealing inconsistency with the inclusion criterion based on the Prolific prescreening).

Although this sample size was not based on any formal power analysis, a larger sample was collected than in previous investigations of this topic (Newall et al., 2020a; Newall et al., 2020b), given that this study uniquely investigated the potential for interaction effects. The final sample of 2025 participants was on average 32.8 years old (SD = 10.4; five did not disclose), and 43.8% female (0.25% no response/prefer not to say). Participants were paid £0.40 each and took 2.74 minutes on average to complete the task (£8.76/hour pro-rata).

The median participant reported gambling on average from 2-4 times a month and for on average between 30 minutes and an hour at a time. Overall, 41.7% of the sample scored four or higher on the Consumption Screen for Problem Gambling scale (Rockloff, 2012), the suggested cut-off for probable disordered gambling symptomology.

Design and materials

Participants were presented with a short introduction to the context of online gambling:

"Imagine that you are a member of an online casino. You have played many of this online casino's games over the last year.

You know that gambling games are designed so that most gamblers lose money over time. Only a percentage of all the money bet gets paid back out as winnings. Or, in other words, that casino games come with a house edge.

You are about to start playing a new online casino game, when you read the following message about the game:"

Following a between-subjects design, participants were randomly allocated to one of the four product message conditions (per-cell *N*s shown in Table 1). Two of these messages were in the return-to-player format: "This game has an average percentage payout of 90%." Two

other messages were in the house-edge format: “This game keeps 10% of all money bet on average.” Message format was crossed with the other factor of volatility statement presence, which were shown immediately below the other information as follows:

“It takes millions of plays for a gambling game to tend towards its average return. A gambling game will not return a minimum value of prizes in any given period of gambling.”

### Measures and procedure

A measure of objective product message understanding was collected via a four-alternative multiple-choice question. “Which of the following best describes what the message means?”, correct answer: “for every £100 bet on this game about £90 is paid out in prizes” (see Table 1 for all potential answers). A measure of perceived chances of winning was collected via a 7-point Likert scale (“very high/high/somewhat high/neither high nor low/somewhat low/low/very low… chance of coming out ahead”). “Very high” was assigned a value of 7 on the scale, and “very low” a value of 1. Each of these measures was collected on a separate screen, with order counterbalanced between-participants. Participants then answered the Consumption Screen for Problem Gambling scale (Rockloff, 2012), a scale of gambling frequency which correlates highly with the degree of disordered gambling symptoms.

### Statistical analysis

The dependent measure of product message understanding was analyzed via a logistic regression, with product message understanding (correct/incorrect) as the outcome measure, and main effects of format and volatility and their interaction as predictors. The dependent measure of perceived chances of winning was analyzed via an ordered logistic regression, because the outcome measure could take one of seven ordered responses. Independent variables were the same as the previous model. All analyses were performed in R.

## Results

A breakdown of responses to the measure of product message understanding is shown in Table 1, and Figure 1 shows the percentage of correct answers in each condition. In line with previous results, there was a difference in the proportion of correct answers when comparing the return-to-player (40.4% and 45.0%) to the house-edge format (66.3% and 70.3%). Following the preregistered analysis plan, a significant main effect of format was observed (OR = 3.49, $z$ = 9.40, $p$ < .001, 95% CI [2.69, 4.54]). The main effect of volatility statement was not significant (OR = 1.21, $z$ = 1.48, $p$ = .14, 95% CI [0.94, 1.55]). Figure 1 also shows that volatility statements improved understanding in the return-to-player conditions (40.4% to 45.0%), but not in the house-edge conditions (70.3% to 66.3%). Indeed, this effect was reflected by a marginally significant interaction term between format and volatility (OR = 0.69, $z$ = 2.02, $p$ = .044, 95% CI [0.48, 0.99]). Following recommendations (Ai & Norton, 2003; McCabe, Halvorson, King, Cao, & Kim, 2020), we also tested the significance of the interaction by comparing the fit statistic (AIC) between a model with and without the interaction term. This second approach was not preregistered. The interaction model offered a better fit (AIC = 2650.47) than the simpler model (AIC = 2652.56). Despite this mild interaction, we note that both versions of the house-edge message were still understood better than both return-to-player messages.

[Table 1 about here]

[Figure 1 about here]

We next performed an exploratory analysis to look at effects across different levels of gambling consumption. Gambling consumption score was entered as a continuous main effect. The model with all possible two- and three-way interaction terms performed better (AIC = 2649.07) than the model with main effects only (AIC = 2650.72). However, the only term close to significant with $p$ = 0.072 was the three-way interaction between all predictors,

leading us to conclude that the key results reported earlier were largely consistent for gamblers of different levels of gambling involvement.

The pattern of responses to participants' perceived chances of winning is shown in Figure 2. The main-effect-only model performed better (AIC = 7413.15) than the model with interactions (AIC = 7414.85), and we therefore report the former. We found a significant main effect of format (OR = 0.42, $z$ = -10.9, $p$ <.001, 95% CI [0.36, 0.49]), with participants reporting lower mean chances of winning across the house-edge (3.47) than return-to-player formats (4.30). There was also a significant main effect of volatility statements (OR = 0.29, $z$ = -15.0, $p$ < .001, 95% CI [0.25, 0.34]), with participants reporting lower mean chances of winning with volatility statements (3.29) than without them (4.47). The lowest mean chances of winning were reported with the house-edge plus volatility statement (2.86).

[Figure 2 about here]

An exploratory analysis was again performed to see how these effects held over different levels of gambling consumption. Here we report the main-effect-only model as it offered a better fit to the data (AIC = 7412.59) than a model with all interaction terms (AIC = 7420.14). All results were qualitatively the same, and the effect of gambling consumption was not significant (OR = 0.98, $z$ = -1.60, $p$ = 0.101, 95% CI [0.95, 1.01]). Again, these results were therefore consistent over different levels of gambling consumption, which is considered a good proxy for disordered gambling (Rockloff, 2012).

Finally, the number of seconds participants took to respond to each scenario was collected. Findings from crowdsourced studies may further lack ecological validity if some fraction of participants complete these items very quickly. Participants took an average of 47.9 seconds (SD=44.7) to complete the understanding item, compared to an average of 40.4 seconds (SD=81.8) for the perception item. In an exploratory analysis, we tested whether log-

transformed response times correlated with accuracy and perceived chance of winning. Time spent answering the understanding question did not lead to improved accuracy (OR = 1.01, $z$ = 0.07, $p$ = .94, 95% CI [0.88, 1.15]). For perceived chances of winning, a simple ordinal regression model showed that participants who took longer had lower perceived chances of winning (OR = 0.69, $z$ = -6.68, $p$ < .001, 95% CI [0.61, 0.77]). However, adding these response times as additional covariates to the main regression models did not alter the significance of any of the other coefficients (results available online; Newall, 2020).

## Discussion

In line with previous results, house-edge messages resulted in lower perceived chances of winning than an equivalent return-to-player message (Newall et al., 2020a). Also in line with previous results from an Australian sample, adding a volatility statement to a return-to-player message also reduced participants' perceived chances of winning (Newall et al., 2020b). This study extended these results by uniquely showing that a volatility statement further reduced perceived chances of winning for a house-edge message. For rates of objective understanding, house-edge messages were again understood better than standalone return-to-player messages, as has previously been observed for a UK sample (Newall et al., 2020a), and also for a return-to-player message plus a volatility statement, as has been observed with an Australian sample (Newall et al., 2020b). An unexpected interaction did occur for rates of objective understanding between message format and the presence of a volatility statement, albeit with little practical effect, as the house-edge-plus-volatility message was correctly understood by 21.3% more gamblers (66.3%) than the return-to-player-plus-volatility message (45.0%). This unexpected pattern of results across the house-edge conditions may be due to a potential ceiling effect with this type of task and recruitment method, as standalone house-edge messages were understood similarly well in previous UK (66.5%; Newall et al., 2020a), and Australian samples (79.9%; Newall et al., 2020b).

A key strength of this study is that it included a large sample of participants drawn from the population of UK online gamblers. However, the study was also limited by being based on self-report measures to a hypothetical scenario. A study using measurements of gambling behavior may have more external validity than the perceived chances of winning used here. The study was based on crowdsourced data, which are not as commonly used in gambling research as in some other disciplines (Mishra & Carleton, 2017). Other potential risk communication improvements, such as the use of graphical decision aides, should also be explored (Garcia-Retamero & Cokely, 2017; Walker, Stange, Dixon, Koehler, & Fugelsang, 2019). There may be drawbacks to including more information in gambling product messages, as gamblers may not attend to highly descriptive messages. It is therefore important that future studies employ process-tracing measures (e.g. eye-tracking) to explore optimal gambling message design, as has been done in the alcohol (Kersbergen & Field, 2017) and tobacco fields (Sillero-Rejon et al., 2020). Future studies should consider whether similar product messages can provide helpful advice in other gambling forms, such as sports betting (Hassanniakalager & Newall, 2019).

The present results showed that gamblers perceive lower chances of winning and display better rates of objective understanding when current standalone return-to-player product messages are replaced to describe the house-edge and volatility of gambling.

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Table 1: Breakdown of responses to the measure of objective product message understanding.

| Response | Return-to-player, standalone (*N* = 505) | Return-to-player, volatility statement (*N* = 502) | House-edge, standalone (*N* = 505) | House-edge, volatility statement (*N* = 513) |
|---|---|---|---|---|
| "90% of people who play this game will win something." | 32.9% | 29.1% | 14.5% | 18.3% |
| "This game will give out a prize 9 times in 10." | 21.8% | 21.9% | 9.7% | 11.1% |
| "If you bet £1 on this game you are guaranteed to win 90p." | 5.0% | 4.0% | 5.5% | 4.3% |
| Correct response: "For every £100 bet on this game about £90 is paid out in prizes." | 40.4% | 45.0% | 70.3% | 66.3% |

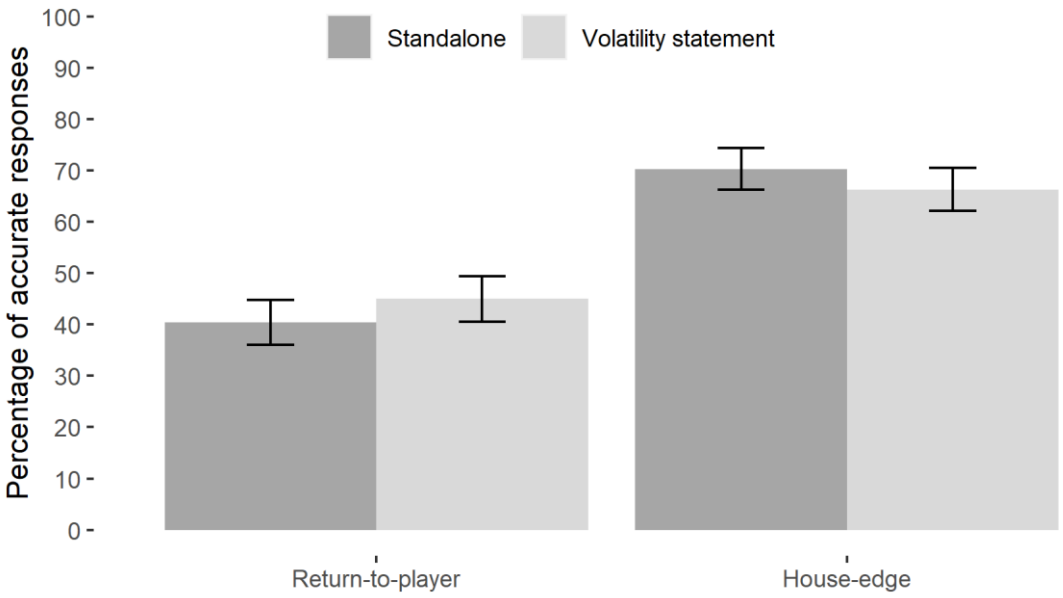


Figure 1: Percentage of participants providing the correct response to the measure of objective product message understanding in each condition. Error bars represent 95% confidence intervals from the logistic regression model.

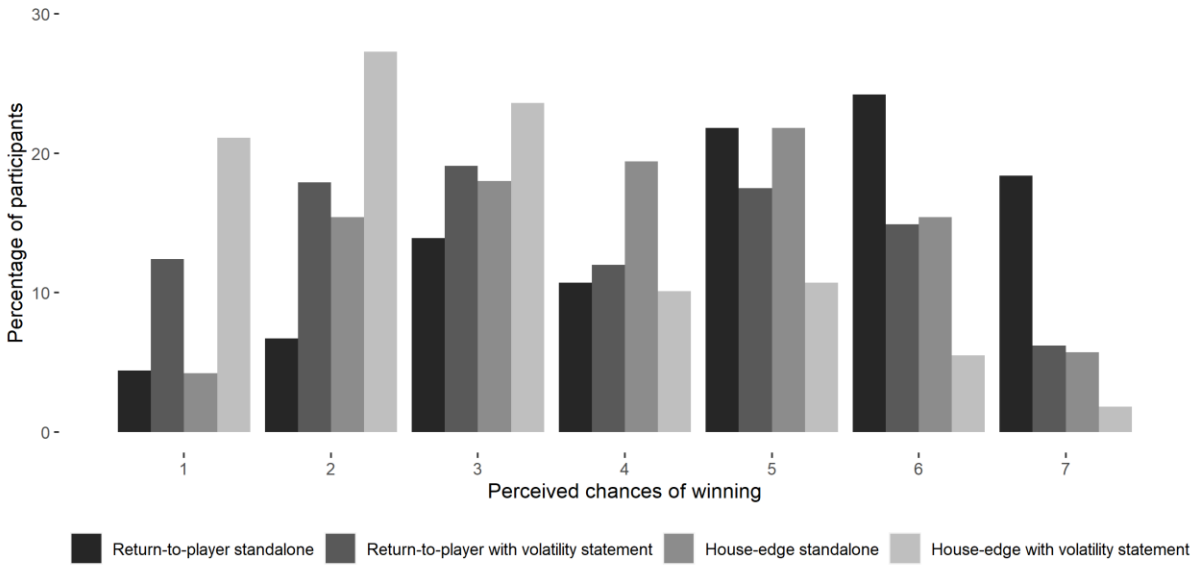


Figure 2: Distribution of perceived chances of winning across variations in message format and volatility statement presence (7 = very high chance of coming out ahead, 1 = very low chance of coming out ahead).