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What is the impact of restrictions on television gambling advertising during live sport? An investigation using quasi-experimental and econometric methods

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Abstract

Introduction: Gambling is a public health problem; gambling advertising is a potential risk factor for gambling harm. This thesis explores the impact of restrictions on gambling advertising on television, with a particular focus on live sports.

Methods: Systematic review and econometric methods using primary self-reported gambling data, and secondary television advertising and scheduling data were used. Quantitative analysis included a quasi-experiment during the 2022 football World Cup, and an econometric analysis of the impact of existing advertising restrictions on the presence of advertising on television. Regression models included linear, count, Propensity Score (PSM), and Inverse Probability Weighted (IPW) matching models.

Results: The existing evidence suggests that sports-related gambling advertising is associated with increases in gambling behaviour. Self-reported effects of advertising appear to be higher in those who are already higher-risk gamblers, and therefore at increased risk of harm. Advertising on television during live World Cup broadcasts influenced the overall frequency of bets placed, and the probability of placing a bet in a higher-risk population group. An industry-led advertising restriction, known as the 'whistle-to-whistle' (W2W) ban, reduced the presence of advertising on television during live football broadcasts, but was associated with an increase in television advertising around live horse racing, which is not subject to the restrictions. Restrictions were associated with little impact on non-sports programming.

Conclusion: This thesis demonstrates that television advertising around live sports increases gambling behaviour amongst a high-risk group despite the introduction of industry-led advertising restriction in 2019, which reduced the total frequency of advertising during live sports. During this time, advertising may have spread to unrestricted live-sports programming. This raises concerns about the overall efficacy of industry-led advertising restrictions. Supported by the precautionary principle, this suggests UK gambling advertising policy may require stronger regulation beyond current self-regulatory measures to effectively address the negative consequences of gambling advertising on gambling behaviour.

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Declaration

I, the author, confirm that the Thesis is my own work. I am aware of the University's Guidance on the Use of Unfair Means (www.sheffield.ac.uk/ssid/unfair-means). This work has not previously been presented for an award at this, or any other, university. Three chapters of this thesis are included in publication format. These are detailed on the following page.

Signed:	***Date:***
Ellen McGrane	24/01/2025

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Publications

Publications included directly in this thesis:

1. **McGrane E, Pryce R, Field M, Gu S, Moore EC, Goyder E. What is the impact of sports-related gambling advertising on gambling behaviour? A systematic review. *Addiction*. 2025. https://doi.org/10.1111/add.16761**

   For this chapter (Chapter Three), I completed all the planning and execution of the systematic review, and I wrote the final manuscript. My supervisors supported me throughout and provided comments on all drafts of the manuscript. My remaining co-authors (EMo & SG) performed secondary reviewing on a section of the review results and provided comments on all drafts of the manuscript.

2. **McGrane, E., Pryce, R., Wilson, L., Field, M., & Goyder, E. (2024). How did the 'whistle-to-whistle' ban affect gambling advertising on TV? A live football matching study. Addiction Research & Theory, 1–9. https://doi.org/10.1080/16066359.2024.2355183**

   For this chapter (Chapter Seven), I completed all the planning, purchasing of data, data analysis and writing of the final manuscript. My supervisors supported me throughout and provided comments on the all drafts of the manuscript. My remaining co-author (LW) provided support for the methodology and commented on all drafts of the manuscript.

3. **McGrane, E., Pryce, R., Field, M., & Goyder, E. (2024). The association between the 'whistle-to-whistle' ban and the presence of gambling advertising on UK television. *Addiction Research & Theory*, 1–10. https://doi.org/10.1080/16066359.2024.2444224**

   For this chapter (Chapter Eight), I completed all the planning, purchasing of data, data analysis and writing of the final manuscript. My supervisors supported me throughout and provided comments on all drafts of the manuscript.

`

Other publications associated with this thesis:

Gambling

1. **McGrane E., Wardle H., Clowes M., Blank L., Pryce R., Field M., et al. What is the evidence that advertising policies could have an impact on gambling-related harms? A systematic umbrella review of the literature. *Public Health*. 2023; 215: 124–130.**

   This manuscript was part of an external research project with Glasgow University for the Greater London Authority (GLA). The GLA requested a synthesis of evidence for the impact of gambling advertising on behaviour and subsequent gambling harms. For this, I led the screening of the review results, wrote the results, and commented on all drafts of the manuscript.

2. **Sharman, S., Piper, T., McGrane, E., & Newall, P. W. Gambling adverts in live TV coverage of the Qatar 2022 FIFA men's world cup. *Addiction Research & Theory*, 1–8. 2023. https://doi-org.sheffield.idm.oclc.org/10.1080/16066359.2023.2245330**

   This manuscript was part of a collaboration between myself and gambling researchers at Bristol University and Kings College London. I undertook this work alongside the study in Chapter Five of this thesis. I used the frequency data from this chapter and compared it to the frequency analysis undertaken by the co-authors and commented on all versions of the manuscript.

3. **Newall, P., Allami, Y., Andrade, M., Ayton, P., et al. (2024), 'No evidence of harm' implies no evidence of safety: Framing the lack of causal evidence in gambling advertising research. *Addiction*, 119: 391-396. https://doi-org.sheffield.idm.oclc.org/10.1111/add.16369**

   This letter was a collaborative effort by gambling researchers across the world, led by Phillip Newall at Bristol University, to re-frame the lack of evidence between gambling advertising and its direct causal relationship with gambling harm. For this, I commented on the final version of the letter and signed the letter.

`

Other

1. **Breeze P., Sworn K., McGrane E., et al. Relationships between sodium, fats and carbohydrates on blood pressure, cholesterol and HbA1c: an umbrella review of systematic reviews. *BMJ Nutrition, Prevention & Health* 2024;7:doi: 10.1136/bmjnph-2023-000666**

   This manuscript was the result of my second research attachment during the first year of my PhD. I worked alongside another student to extract data from a systematic review that explored the relationship between micronutrients and health outcomes. I also helped to produce a conceptual map for this. I commented on all versions of the manuscript.

2. **Keetharuth, A.D., Gray, L.A., McGrane, E. et al. Mapping Short Warwick and Edinburgh Mental Wellbeing Scale (SWEMWBS) to Recovering Quality of Life (ReQoL) to estimate health utilities. *Health Qual Life Outcomes* 22, 7 (2024). https://doi-org.sheffield.idm.oclc.org/10.1186/s12955-023-02220-z**

   This final paper came from my third research attachment during the first year of my PhD. For this, I cleaned and analysed data on health-related quality of life. I ran several mapping functions (Ordinary Least Square, Tobit, Generalised Linear Models, and Response Mapping) to estimate health-state utilities for a mental wellbeing scale and ran simulations of these to determine the optimal model. I commented on all versions of the manuscript.

`

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In the words of the greatest animated character of all time:

"Someday I will repay you. Unless, of course, I can't find you, or if I forget" – Shrek (2004)

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Abbreviations

ACCA	Accumulator
APA	American Psychiatric Association
ASA	Advertising Standards Authority
AUDIT-C	Alcohol Use Disorders Identification Test for Consumption
BARB	Broadcast Audience Research Board
BGC	Betting and Gaming Council
BoB	Box of Broadcasts
CAP	Committee of Advertising Practice
CDoH	Commercial Determinants of Health
CI	Confidence interval
CSR	Corporate Social Responsibility
DCMS	Department for Culture, Media and Sport
DSM-5	Diagnostic and Statistical Manual of Mental Disorders 5th Edition
EGM	Electronic Gaming Machine
FA	Football Association
FIFA	International Federation of Association Football (Fédération Internationale de Football Association)
GLA	Greater London Authority
Greo	Gambling Research Exchange Ontario
ICC	International Cricket Council
ICD-11	International Classification of Diseases 11th Edition
IGRG	Industry Group for Responsible Gambling
IPW	Inverse Probability Weighted
IRR	Incidence Rate Ratio
MMAT	Mixed Methods Appraisal Tool
NGP	New Gambling Product
NGTS	National Gambling Treatment Service
NIHR	National Institute for Health and Care Research

Ofcom	The Office of Communications
OHID	Office for Health Improvement and Disparities
OR	Odds Ratio
PGSI	Problem Gambling Severity Index
PHE	Public Health England
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PSM	Propensity Score Matching
SD	Standard Deviation
SE	Standard Error
TfL	Transport for London
TV	Television
WHO	World Health Organisation
W2W	Whistle-to-Whistle

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Glossary

Accumulator Bet: A bet which combines multiple bets into a single bet. It usually comprises four or more bets and requires all of them to win to make a return. Winnings tend to be much higher, with an increased risk associated with them.

Affiliate Advertising: When a third-party organisation advertises for a company. For example, an affiliate might share a gambling operator's advertisement which leads to increased traffic for the operator. The affiliate will usually be paid a commission for this.

Aggregate Advertising: In this thesis, aggregate advertising is where advertising is measured in total (i.e. total frequency of exposure to all types of advertising).

Alcohol-Use Disorders Identification Test: A screening measure used to identify unhealthy alcohol use including risky and hazardous use, and probable alcohol dependence.

Balance Test: Tests the balance of covariates between a matched and unmatched sample. The test has a null hypothesis that the matched sample improves the balance of covariates, making the sample more equivalent to a randomised sample, and reducing bias in the model; the treated and control groups are more alike.

Betting and Gaming Council: The primary (non-governmental) gambling industry body in the United Kingdom. It aims to ensure fair, safe, and enjoyable gambling and to provide a voice for the industry.

Binary Variable: A variable used in a statistical model that has two values (0 and 1). It usually represents 'yes' or 'no'; i.e. advertising is present, or advertising is not present.

Box of Broadcasts: An online service that allows the user to stream free-to-air television broadcasts.

Broadcast Audience Research Board: The organisation that compiles viewing figures and ratings for broadcast television in the United Kingdom (now known as Barb Audiences Ltd).

Caliper: A caliper is used in a Propensity Score Matching model (see below). It indicates the total distance between the scores of the matched observations. Wider calipers are less precise matches but allow for the use of a larger amount of data.

Commercial Determinants of Health: The commercial systems, practices, pathways, and factors that drive health.

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Comprehensive Advertising Restrictions: Restrictions on all, or nearly all, types of gambling advertising.

Confidence Interval: A range of values around an estimate that represents the variability in precision of that estimate. The interval is expected to contain the estimate itself. A wider interval suggests less precise estimates.

Conflict of Interest: The circumstances where a person's judgement or actions may (or potentially) be influenced by another interest. An actual conflict of interest might be a gambling researcher taking direct funding from the gambling industry to carry out a research project. A potential conflict of interest might be a gambling researcher having meetings with the gambling industry.

Control Variable: A variable that is held constant in a model to control for the influence of other factors, besides the independent variable, on the dependent variable.

Cross-sectional Study: A study that observes a population at one point in time. Cross-sectional studies can be repeated over time but observe different populations at each time point.

Daytime (Watershed) Advertising Ban: An industry self-regulatory mechanism where television advertising for gambling is not allowed between the hours of 5:30am and 9:00pm in the United Kingdom. This excludes lottery and bingo products, and advertisements around live sports broadcasts.

Dependent Variable: The variable that is being tested in a statistical model. It is sometimes referred to as the outcome variable.

Diagnostic and Statistics Manual of Mental Disorders: A manual that defines mental health and brain-related disorders. It is used by medical professionals for diagnosis purposes, most commonly in the USA.

Digital Advertising: Online advertising such as advertising on websites and social media.

Direct Messaging: A type of advertising that is sent directly to the person, who would usually opt into or out of receiving it. Examples include direct emails and text messages.

Dose-response: Describes the magnitude of response relating to dose (exposure) to something. In this context, it would describe the marginal increase in gambling behaviour following exposure to an additional gambling advertisement.

Ecological Momentary Assessment: Repeatedly sampling respondents experiences, or behaviours, in real-time, real-world contexts. It can use diaries to measure people's gambling behaviour over multiple time points in a day. It helps to minimise recall bias and increase the external validity of data.

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Ecological Validity: A type of external validity that indicates how well a study reflects the real-world, or real-life situations.

Econometric Methods: The application of statistical methods to economic data.

Efficacy: The extent to which something has had the intended, or desired, effect.

Endogeneity: The situation where an explanatory variable in the statistical model is associated with the error term. As such, there is bias in the identified effect, and causality cannot be inferred. It may occur from omitting an important variable in the statistical model, or when the explanatory variable can cause the outcome variable at the same time as the outcome variable can cause the explanatory variable.

Embedded Advertising: Advertising that occurs during a live sports game, but that is not TV advertising. Examples include sponsorship (e.g. on football shirts) or pitch-side advertising.

Exogenous: Originating from outside of somewhere.

Experimental Research: A type of study where the researcher has direct control over key variables and can set the conditions for testing their effects. The researcher can alter one variable and determine the potential causal relationship between two variables. In this context, a researcher can alter exposure to gambling advertising and measure gambling behaviour in a controlled environment, where the impact of external factors is minimised.

External Validity: The ability to apply the conclusions of research to contexts outside of the research itself. It indicates how generalisable the findings are.

Exploratory Research: A type of preliminary research that gives a deeper understanding of a problem, often when it has not yet been clearly defined. It can identify the nature of the problem and suggest that additional research may be undertaken in the future.

Feasibility Study: A study that tests whether something should be done, and how it should be done.

Fixed Effects: A statistical model that controls for all variables providing they stay constant. It can control for variables that are missing. An example variable might be race.

Gambling: The action of exchanging money for games, or betting on an uncertain outcome with the chance of making a return. It can be either online or offline, and examples include the lottery, bingo, casino games, electronic gaming machines, and betting on sports events.

Gambling Advertising: All types of gambling advertising, marketing, and promotion (including traditional, digital, direct, embedded, and specific inducements).

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Gambling Dependence (or Gambling Disorder, or 'Problem Gambling'): A pattern of persistent behaviour, either online or offline, resulting in significant negative impacts on the person, their family, and society. This is characterised more specifically in the ICD-11 and DSM-5 and is the equivalent of scoring greater than or equal to 8 on the PGSI.

Gambling Survey for Great Britain: Collects official statistics on gambling behaviour in Great Britain.

The Gambling Commission: A government body responsible for regulating the gambling industry in Great Britain.

General Gambling Harms: Gambling harms that are experienced at lower or moderate levels of gambling, before reaching 'crisis' harms (where intervention is sought). Some examples are a reduction in savings, short-term cash flow issues, and psychological distress.

Grey Literature: Materials or research that are not published in academic peer-reviewed journals. Examples include government reports, conference presentations, and working papers.

Higher-Risk Gambling Population: Throughout this thesis, the term refers to individuals at higher risk of gambling-related harm, as identified by the Problem Gambling Severity Index (PGSI). These individuals are more likely to fall into the higher-risk categories of the PGSI, indicating a greater likelihood of gambling dependence and an elevated risk of associated harm.

Health Economic Modelling: A simplification of a real-world problem to aid decision making. These models can be used to estimate the costs and benefits of medical treatment, and to decide whether they are worth investing in. They can also estimate the impact of policies, such as taxes on cigarettes and alcohol, on the behaviours and health outcomes of a population.

Health-related Quality of Life: A multi-dimensional measure of the impact of health on quality of life. Common measures include questions on physical mobility, self-care, pain, and depression. The measure results in a number that represents that health state.

'Impulse' Bet: Unplanned betting that does not involve careful thought or consideration of the bet or its likely outcome.

Incidence Rate Ratio: The ratio between the likelihood of something happening between two groups. It is calculated as the incidence (occurrence) in one group divided by the incidence (occurrence) in another group, e.g. treated versus control.

Independent (Explanatory) Variable: The key variable that is being changed in a statistical model to test its effects on the outcome (dependent) variable.

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Inducements: A financial, or non-financial, benefit offered to customers in an advertisement. Examples include free bets for opening a new account. They tend to reduce the cost, or risk, of betting.

International Statistical Classification of Disease and Related Health Problems: A service that medically classifies health conditions for clinical purposes. It provides codes for classifying and diagnosing health conditions.

In-play Betting: A more intensive form of sports betting that allows the player to bet during a live sports game.

Internal Validity: The extent to which a causal relationship is being measured within a research study.

Inverse Probability Weighted Matching: A matching model that is like Propensity Score Matching but uses weighting to better balance the characteristics of treatment and control groups. The weight used is 1 divided by the propensity score (probability of being treated).

Legacy Gambling Harms: Gambling harms that continue after the gambler has stopped engaging in the behaviour. Examples might include the breakdown of a marriage, the loss of a house, or long-term debts.

Lifecourse (Intergenerational) Gambling Harms: A second-order, long-term, gambling harm that changes the life course of a person or people, e.g. loss of an individual or harm passed on through generations.

Linear Television: Traditional broadcast television provided via cable or satellite television.

Linear Model: A model that describes the relationship between variables and assumes normality of the data (see below).

Longitudinal (Panel) Research: Research that follows the same individuals over time.

Logistic Model: A statistical regression model that models the relationship between variables with a finite outcome e.g. yes or no. In this context, the regression model will display the probability of a person placing a bet, based on several other factors, one being advertising.

Loss Chasing: Intensified betting when facing persistent losses. A bettor will 'chase' their loss and try to win it back.

Matching Methods: A statistical method that identifies a treated group that most resembles the control group in an observational or quasi-experimental study. It

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minimises bias in a study by choosing a treated unit that is most similar in terms of observable characteristics to a control unit.

Measurement Bias: Non-random errors in the measurement of a variable in a study. For example, a participant might misunderstand a question or might respond in a way that they believe is socially desirable e.g. reporting that they gamble on fewer occasions.

Meta-analysis: A statistical method that combines the quantitative results of various studies (measuring the same variable) to obtain a single quantitative estimate of effect.

Micro-betting: A particularly continuous form of in-play sports betting that allows players to bet on smaller, short-term, events during a live sports game. Examples include a player taking a corner during a football game. This type of gambling is riskier since there is less skill involved, and the outcome is determined very quickly.

Multiple Bet: A linked series of bets on which the outcome depends. Examples include a double, treble, or accumulator.

Narrative Synthesis: A descriptive (qualitative) approach to synthesise studies in a review. This is the opposite of a meta-analysis (quantitative).

New Gambling Product: A term used in the industry's advertising code of practice which refers to all gambling products except lottery and bingo.

Normality: Data that follows a normal distribution, or a bell-shaped curve.

Observational Study: A study where the researcher observes a sample of individuals without manipulation or intervention. This may be due to ethical or logistical restrictions.

Odds Ratio: A measure of the association between an exposure and an outcome. It represents the odds that the outcome will occur alongside a specific exposure, compared to the odds that the outcome will occur alongside an absence of a specific exposure.

Partial Advertising Restrictions: Some forms of restriction on some types of gambling advertising.

Pilot Study: A type of feasibility study. A small-scale study that is conducted prior to a full study to evaluate its methods and procedures. It can improve the design of the final study by assessing the feasibility, costs and unintended consequences of a study design before undertaking the full study. It usually has a specific design feature which can be tested, and the data collected can be included in the final dataset.

Poisson Model: A statistical model that is used to model count data; data which has low values and a higher number of zeros.

Post-match Section: Any time following the 5 minutes after the final 'whistle' of a live sports game, but before the end of a broadcast.

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The Precautionary Principle: An approach which encourages the adoption of harm prevention measures in the absence of certain scientific evidence.

Pre-match Section: Any time after the start of a broadcast, but prior to the 5 minutes before the first 'whistle' of a live sports game.

The Prevention Paradox: The paradoxical phenomena that the majority of illness or disease comes from people in the lower-to-moderate risk population. It occurs because there are a much larger number of people in these groups, so the magnitude of impact is much greater.

Problem Gambling Severity Index: A general population tool used to screen for gambling dependence. It has nine items with a four-point scale ('never' to 'almost always'). Final scores range from 0 to 27 where: 0 (no risk), 1-2 (low-risk), 3-7 (moderate-risk), 8+ ('problem' gambling).

Prolific: An online panel for collecting data.

Propensity Score Matching: A statistical model that matches treated and control observations based on a score. This score is generated using a regression of treatment on the specified matching characteristics. The score is between 0 and 1 and represents the probability of being treated. The model matches observations with similar scores, but differing treatment.

Proxy Variable: A variable that can be used to indirectly estimate another variable with which it is correlated. It must be correlated with the variable that is intended to be measured and must not be related to the error term in the model.

Pseudo-random: When something has not been randomised, but its allocation mimics a randomised pattern.

Publication Bias: When the outcome of a study biases a decision to publish it e.g. a null result leading to non-publication. It can also refer to the non-publication of non-academic outputs, such as government reports or working papers.

Purposive Sampling: A type of sampling which seeks participants based on selected characteristics or criteria. It is a form of non-probability sampling.

P-value: The probability of a type-1 error, when a researcher rejects the true null hypothesis. Researchers will usually set the maximum probability of this error at 0.05 (5%). Any p-value less than 0.05 is judged to be statistically significant because the probability of this error is below the acceptable threshold.

Recall Bias: When a participant does not accurately remember past events, such as their gambling behaviour. It can lead to systematic errors in data.

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Reverse Causality: A type of endogeneity where the explanatory variable (e.g. gambling advertising) may cause the outcome variable (e.g. gambling behaviour), but the same exists vice versa. The researcher cannot identify the direction of causality between the variables.

Safer Gambling Advertisements: A type of advertisement that encourages people to take a break from, or stop, their gambling. All advertisements should carry information on safer gambling practices, but some advertisements are specifically designated to this.

Selenium (in R-programming): A tool that can be used for web scraping. It automates a web browser and browses it locally or remotely, and can extract data from a webpage and store it in R. It is commonly used with Python.

Self-selection Bias: Bias caused when individuals select themselves into a group in a non-probability sample. The reasons for self-selecting into this group might bias the results of the study.

Self-regulation: Regulation that is carried out by alternative bodies (e.g. the gambling industry) to government bodies (e.g. the Gambling Commission). This applies to advertising restrictions that are industry-led.

Serial Position Effect: The tendency for people to better recall things at the beginning and end of a list, compared to the middle.

Short Gambling Harms Scale: A tool to measure the prevalence and degree of harm from gambling in the general population. It is intended to be more sensitive than other measures that focus on people who are most likely dependent on gambling.

Single Bet: A bet placed on a single event only e.g. a football team winning a match. They are less risky but give a lower return compared to multiple bets.

Sports-related Gambling Advertising: Any form of advertising by gambling companies if present during, or related to, any sport game or sports betting product. As such, the content of advertising may expand beyond sports products if it occurs in, or around, sports (e.g. on television during live sports).

Spreading Effect (Advertising): This occurs when a partial advertising ban has been implemented, and advertising spreads from the restricted section into the unrestricted section.

Standard Deviation: Measures the variation between specific data points and the mean value. It tells you how spread out the data is, by measuring how far each estimate is from the mean.

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Standard Error: A statistic that represents how accurately the sample data represents the entire population. It estimates the magnitude of variation around the estimate and is a means of calculating the confidence interval.

Standardised Mean Difference: The difference between the means of a variable from two groups, expressed in terms of the standard deviation. It is often used to measure the balance between treatment and control groups in propensity score matching models.

STATA: A statistical software programme used for data manipulation, visualisation and analysis in research.

Statistical Significance: Helps researchers to quantify whether a result was most likely due to chance, or the factor being measured; see definition of p-value. This is often set at 0.05 (minimum 5% chance of getting a type 1 error).

Statutory Advertising Restrictions: Advertising restrictions that are legally enforced by the government.

Statutory Gambling Industry Levy: A tax, or fee, on the gambling industry that is paid based on Gross Gambling Yields (or profit). It is paid to the Gambling Commission and is used for prevention, research and treatment purposes.

Substitution Effect (Advertising): When the content of an advertisement is substituted for another. For example, when partial advertising restrictions are in place, an advertisement for a restricted product (e.g. casino betting) might be replaced with an advertisement for an unrestricted product (e.g. bingo).

Systematic Review: A systematic method of identifying and synthesising all of the available literature on a subject. It should be transparent and reproducible.

Total Consumption Theory: Describes the association between total consumption and the prevalence of harmful consumption or harms in a population.

Traditional Advertising: Television, radio and print advertising.

Unintended Consequences: The outcomes of an action that were not intended. These can be positive or negative and often occur in response to policy change.

Video On-demand: A service that allows a viewer to select a programme that they want to watch at any time.

Voluntary Advertising Restrictions: Advertising restrictions that are not legally enforced and are usually implemented by an industry or organisation.

Qualtrics: An online survey platform.

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Quasi-experiment: A study that evaluates an intervention without using randomisation assigned by the researcher. An example is a natural experiment which occurs in a naturalistic real-world setting.

R-programming: A computer programming language used for data analysis and visualisation.

Variance Ratio: The ratio of the variance for each variable, often compared between treated and control groups in propensity score matching models.

Watershed: Daytime broadcast television running from 5:30am to 9:00pm. It is used to identify the time when television is most likely viewed by children.

Web Scraping: The process of using a programme to extract data from a website using the underlying HTML (Hypertext Markup Language) code.

'Whistle-to-Whistle' Ban: An industry restriction on gambling advertising that does not allow television gambling advertisements to be present in the five minutes before a live sports game (i.e. the first 'whistle'), during any intermittent break periods, and in the five minutes after a live sports game has ended (i.e. the final 'whistle').

2005 Gambling Act: The primary act which controls all forms of gambling in the United Kingdom. It mostly covers England, Scotland and Wales, but there are some 'reserved matters' for Northern Ireland (e.g. advertising).

2023 Gambling White Paper: Following a review of the 2005 Gambling Act, this set-out plans for the reform of gambling legislation in the United Kingdom. Key changes include a statutory levy on the industry and a limit on online slot stakes.

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Chapter One: Introduction

1.1 Summary

Academics and policy stakeholders have expressed concern about the advertising of unhealthy commodities in sport. Attention has concentrated on tobacco, unhealthy food and drink, and alcohol (World Health Organisation, 2003; Flint and Peake, 2016; Ireland *et al.*, 2019; Ireland, 2020; Bradshaw, Crowther and Viggars, 2021; Purves, Morgan and Critchlow, 2022), with focus more recently shifting towards gambling (Chambers and Sassi, 2019; Purves *et al.*, 2020; Ireland *et al.*, 2021; Greenwood, Mold and Wardle, 2023; Wardle *et al.*, 2024). Following the liberalisation of advertising laws in the 2005 Gambling Act, there has been rising concern about the impact of gambling advertising on gambling behaviour, and subsequent population health. Despite this, in 2023, the UK government announced very few changes to existing advertising legislation (Department for Culture, Media and Sport (DCMS), 2023). For the most part, gambling advertising is self-regulated by the industry in the UK (Industry Group for Responsible Gambling, 2023). To date, there has been a lack of evidence for the effects of this self-regulation on the presence of gambling advertising and its subsequent behavioural impact. Live sports programming has been exempt from industry advertising restrictions for many years. This thesis aims to fill an important evidence gap by exploring the impact of restrictions on gambling advertising around live sports in the UK.

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1.2 Underlying Philosophy and Approach of this Thesis

This thesis takes a pragmatic, quantitative approach to strengthen the empirical foundations of existing research in this area. Instead of aligning with a specific theoretical framework, it instead focuses on measuring causal effects and enhancing the external validity of studies by examining real-world contexts. Much of the existing research in this area relies on cross-sectional methodology which cannot verify the direction of the causal relationship between advertising and behaviour, or controlled experiments, which can establish causality but often lack external validity due to artificial experimental conditions. This thesis addresses these limitations.

1.3 Overview of the Main Research Chapters

The thesis is divided into nine chapters, with Chapters Three to Eight representing the core research chapters.

Chapter Three: A systematic literature review of existing studies on gambling advertising and gambling behaviour, identifying strengths, limitations, and research gaps.

Chapter Four: A small feasibility study testing methods for estimating the causal effect of gambling advertising, used in Chapter Five.

Chapter Five: A larger natural quasi-experiment estimating the causal effect of television gambling advertising on gambling behaviour during the 2022 FIFA World Cup.

Chapter Six: A pilot study exploring future methods for estimating the causal effect of gambling advertising in real-world contexts.

Chapter Seven: A quasi-experimental matching study assessing the impact of the UK's 'whistle-to-whistle ban' on the number of gambling advertisements around live televised football.

Chapter Eight: A descriptive study exploring the wider effect of UK's 'whistle-to-whistle ban' on gambling advertising on UK television.

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1.4 Sequence of the Research Chapters

The sequence of the research chapters reflects two central aims: Chapters Three to Six examine the impact of gambling advertising on gambling behaviour, and Chapters Seven and Eight quantify the impact of a real-world gambling advertising restriction. This two-part structure was necessary given the absence of data on gambling behaviour in the UK, which made it impossible to explore these two aims simultaneously. Accordingly, the first section focuses on collecting primary data on gambling behaviour to estimate the behavioural effects of advertising, followed by a retrospective analysis of the impact of an advertising restriction (the UK's 'whistle-to-whistle ban') on real-world advertising exposure.

1.5 Research Chapter Methods

As mentioned above, this thesis adopts a broadly quantitative economic approach, aiming to advance existing research by estimating causality in a real-world setting. As such, it employs quasi-experimental approaches which offer a stronger basis for estimating causal effects, but which have been notably underused in gambling advertising research to date. Methods include natural experiments and matching techniques. These are applied to real-world setting such as the 2022 FIFA World Cup and the UK's 'whistle-to-whistle ban'. The content of the thesis is summarised in more detail below.

1.6 Full Thesis outline

Chapter Two

Chapter Two describes the background to this thesis including a definition of gambling, its epidemiology, gambling research, gambling policy, and gambling advertising. It defines the motivation behind this thesis and illustrates its specific aims and research questions to frame the remainder of the thesis.

Chapter Three

Chapter Three is one of three chapters included in publication format. This is an Accepted Manuscript of an article published by Wiley in Addiction on 11/01/2025, available online: https://doi.org/10.1111/add.16761.

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The title of this manuscript is: “What is the impact of sports-related gambling advertising on gambling behaviour? A systematic review.”

Authors: Ellen McGrane, Elizabeth Goyder, Robert Pryce, Matt Field, Esther Moore & Shangshang Gu

Chapter Four

Chapter Four defines a feasibility study which tests and refines the methods for Chapter Five of this thesis. This study collects gambling data from a small sample of men during the European World Cup Qualifying playoff matches in March 2022, to test the recruitment and data collection methods for the full study. This chapter describes the aims of this study, its findings, and how these findings contributed to the final design of the study in Chapter Five.

Chapter Five

Chapter Five describes a quasi-experimental study, carried out during the men’s 2022 International Federation of Association Football (FIFA) World Cup in Qatar, to estimate the impact of television gambling advertising on gambling behaviour amongst a higher-risk population group. This chapter explains the setup of the study, the methods used, its results, and the implications of these results considering its strengths and limitations.

Chapter Six

Chapter Six concludes the first section of this thesis which focuses on the impact of sports-related gambling advertising on gambling behaviour. It outlines a plan for a pilot study which aims to address some of the limitations of the study in Chapter Five, whilst replicating its quasi-experimental design. Due to practical issues, there are no results reported in this chapter, but the study methods have been included given that it was an important part of the original research plan for this thesis. The chapter reflects on the challenges faced in this study, and provides suggestions for future research.

Chapter Seven

Chapter Seven is the second of three chapters included in publication format. This is an Accepted Manuscript of an article published by Taylor & Francis in Addiction Research

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and Theory on 20/05/2024, available online: https://doi.org/10.1080/16066359.2024.2355183

The title of this manuscript is: “How did the ‘whistle-to-whistle’ ban affect gambling advertising on TV? A live football matching study.”

Authors: Ellen McGrane, Elizabeth Goyder, Robert Pryce, Matt Field, Luke Wilson

Chapter Eight

Chapter Eight is the third of three chapters included in publication format. This is an Accepted Manuscript of an article published by Taylor & Francis in Addiction Research and Theory on 24/12/2024 , available online: https://doi.org/10.1080/16066359.2024.2444224

The title of this manuscript is: “The association between the ‘whistle-to-whistle’ ban and the presence of gambling advertising on UK television”

Authors: Ellen McGrane, Elizabeth Goyder, Robert Pryce, Matt Field

Chapter Nine

Finally, Chapter Nine summarises the results of this thesis and describes its unique contribution to the research area. This includes the use of economic quasi-experimental methods, and the application of real-world sporting events and gambling advertising restrictions, which produce more ecologically valid findings. It also contributes to our understanding of an important, yet historically neglected, public health issue. It outlines the strengths and weaknesses of this thesis, the implications of its findings for future gambling research and policy, and some reflections on my experiences during the PhD.

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Chapter Two: Background

2.1 Chapter Overview

In this chapter, I will outline the epidemiology of gambling, gambling research, and gambling policy in the UK, before explaining the motivation for this thesis. Finally, I will illustrate its specific aims and research questions.

2.2 The Commercial Determinants of Health

Whilst it is not disputed that the commercial sector can positively impact population health, there is evidence that specific commercial bodies are producing avoidable ill-health, and inequities in health and social outcomes (Gilmore *et al.*, 2023). The Commercial Determinants of Health (CDoH) are the commercial systems, practices, pathways, and factors that drive health (West and Marteau, 2013; Gilmore *et al.*, 2023). Alternative definitions emphasise their negative impact on health (Kickbusch, Allen and Franz, 2016). Around one third of annual global deaths can be attributed to four commercial industries: tobacco, unhealthy food, fossil fuels, and alcohol (Institute for Health Metrics and Evaluation, 2021). Negative health impacts can arise from commercial products themselves, or the influence of commercial entities on health policy. Despite similarities across health fields, there is little definitional consensus (Gilmore *et al.*, 2023). An emerging research area is gambling, an industry which is less often included in definitions (de Lacy-Vawdon and Livingstone, 2020; Gilmore *et al.*, 2023). Like alcohol, commercial gambling entities frame gambling as the problem of a limited number of irresponsible individuals (Gilmore *et al.*, 2023). The industry engage in a number of congruent and reinforcing practices, the 'corporate playbook' (Freudenberg,

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2014; Knai *et al.*, 2021; Lacy-Nichols *et al.*, 2022), which influence policy and their commercial reputation. Researchers argue that the World Health Organisation (WHO), and governments, should expand regulatory approaches beyond the more recognised CDoH to include industries such as gambling (Friel *et al.*, 2023).

Framing gambling in a CDoH lens is important to increase its legitimacy alongside more established determinants such as alcohol of tobacco. The gambling industry shares many of the same practices – particularly in advertising – as these other commercial entities, and an effective policy approach to gambling might share similar characteristics with those sectors as a result. Positioning gambling in this framework not only underscores these parallels but also supports the development of a more cohesive policy response across industries with similar public health implications and brings gambling into these policy discussions alongside other CDoH.

2.3 Definition of Gambling

Gambling is the action of exchanging money for games, or betting on an uncertain outcome with the chance of making a return (Oxford University Press, 2013; The Gambling Commission, 2024a; The World Health Organisation (WHO), 2024). Betting can occur on the outcome of a competition or event, the likelihood of an event occurring, or whether something is true (The UK Parliament, 2005). It can be undertaken online or in-person. Activities include, but are not limited to, lotteries, scratch cards, betting on sports events, online casinos, and Electronic Gaming Machines (EGMs).

Gambling disorder is the only behavioural disorder, aside from gaming disorder, included in the International Statistical Classification of Disease and Related Health Problems '*Substance use or addictive behaviours'* category (11th ed.; ICD-11; WHO, 2019). It is included alongside nicotine, alcohol, and other illicit drugs, and was previously categorised under *'Habit and impulse control disorders'* (WHO, 2019). Gambling disorder is recognised by the Diagnostic and Statistics Manual of Mental Disorders (5th ed.; DSM-5; American Psychiatric Association, 2013) as a recurrent behaviour that leads to impairment or distress. The definition includes a preoccupation with gambling, a loss of control over the behaviour, and concealing gambling from family and friends. The DSM-5 and ICD-11 are global diagnostic tools designed for use in a clinical context. A

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commonly used tool in the UK is the Problem Gambling Severity Index (PGSI). This is a general population screening tool with nine items covering topics such as betting more than you can afford, experiencing health problems related to gambling, and feeling guilt due to gambling (The Gambling Commission, 2024c).

2.4 The Epidemiology of Gambling

2.4.1 The Prevalence of Gambling in the UK

Gambling is permitted in more than 80% of countries around the world (Wardle *et al.*, 2024). The most updated figures for gambling participation in the UK are from the second wave of the Gambling Survey for Great Britain (The Gambling Commission, 2024d), a nationally representative survey of adults. Almost half of respondents report gambling at least once in the last 4 weeks. This figure reduces to one third when excluding lottery draws. Males aged 45 to 64 have the highest participation rates; 25 to 34 when excluding lotteries. The most popular activities are lotteries (47%), scratchcards (12%), betting including sports and race betting (12%), and online instant-win games (7%). Participation figures for Northern Ireland slightly differ; ages 35 to 44 have the highest participation rate, and the most popular activities are the National Lottery (47%), scratchcards (24%), betting including sports and race betting (23%), and other lotteries (21%). However, these figures are measured across 12 months and are quite outdated (The Department for Communities (DfC), 2017). Expenditure on gambling in Great Britain is concentrated in a smaller group of higher-risk gamblers (Wardle *et al.*, 2023); those who score more highly on the PGSI.

In Great Britain, it is predicted that 2.5% of the population are classified as having gambling disorder (PGSI score above 8) and a further 3.7% are at risk of gambling problems (The Gambling Commission, 2023). Males are more likely to have a higher PGSI score than females, and those aged 18-34 are also more likely to score in the higher-risk categories (The Gambling Commission, 2023). Rates are similar in Northern Ireland (DfC, 2017). In Great Britain, 7% of the population report having been affected by someone else's gambling (Public Health England (PHE), 2023).

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2.4.2 Sociodemographic and Behavioural Risk Factors

The highest rates of participation in gambling are observed in employed individuals, with higher qualifications, who are from less economically deprived areas in England (PHE, 2023). Contrastingly, the highest rates of gambling harm are experienced by unemployed individuals in areas of heightened deprivation, suggesting a link between gambling and health inequalities (PHE, 2023). Gambling, and the risk of its harms, are associated with both mental and physical health, with those in a poorer health state reporting a greater risk of harm. Gambling is also associated with increased alcohol consumption (PHE, 2023). Affected others are more likely to be women, with immediate family members reporting the most severe impacts (PHE, 2023). Many risk factors are similar for the rest of the UK, where they are reported (The Department for Communities (DfC), 2017; The Welsh Government, 2024). Demographic risk factors from the literature include being younger, male, living alone, facing financial struggles and having a lower educational level (Dowling *et al.*, 2017; Russell *et al.*, 2019; Moreira, Azeredo and Dias, 2023). Other behavioural risk factors may include alcohol and drug use, depression, self and peer antisocial behaviour, poorer academic performance, sensation seeking, and impulsivity (Dowling *et al.*, 2017).

2.4.3 Gambling Harms in the UK

The direct financial and social costs of gambling harms are projected to be £1.05 to £1.77 billion for England; this is likely underestimated due to the lack of complete data (PHE, 2023). Figures for the rest of the UK are £60 million (Scotland) and £40 to £70 million (Wales) (Rogers *et al.*, 2019; Public Health Scotland, 2024). There are no comparable estimates for Northern Ireland.

Gambling harms include harms to resources, relationships, health, and more. Harms to resources can affect personal finances (e.g. debt), individual employment (e.g. time off work), and broader societal resources, including impacts on unemployment and crime (e.g. fraud). See Figure 1 for a summary of gambling harms based on existing frameworks. Harms can impact the individual gambler, their family and friends, and wider society (Langham *et al.*, 2016; Wardle *et al.*, 2018; Marionneau, Egerer and Raisamo, 2023). Legacy harms may also occur, which describe the continuation of harms after gambling has ceased (Langham *et al.*, 2016). Gambling disorder can lead to the breakdown of

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relationships and financial instability. It is highly co-morbid with other mental health problems and substance use disorders (Shaffer and Korn, 2002; The Lancet, 2017; Wardle *et al.*, 2019; Abbott, 2020; Håkansson and Karlsson, 2020; PHE, 2023). An estimated 409 gambling-related suicides occurred in England in 2018, but this is likely underreported (PHE, 2023). A study by Wardle *et al.*, (2020) reported that 20% of 'problem gamblers' had experienced suicidal thoughts in the past year, and 5% had attempted suicide. These were larger percentages compared to other higher-risk and 'non-problem' gamblers. Gambling has been recognised as a potential risk factor for suicide in the England Suicide Prevention Plan (Department of Health and Social Care (DHSC), 2023). There are no comparable figures for the rest of the UK. However, a study on treatment-seeking gamblers in the UK reported that around 30% had attempted suicide prior to entering treatment (Sharman *et al.*, 2019).

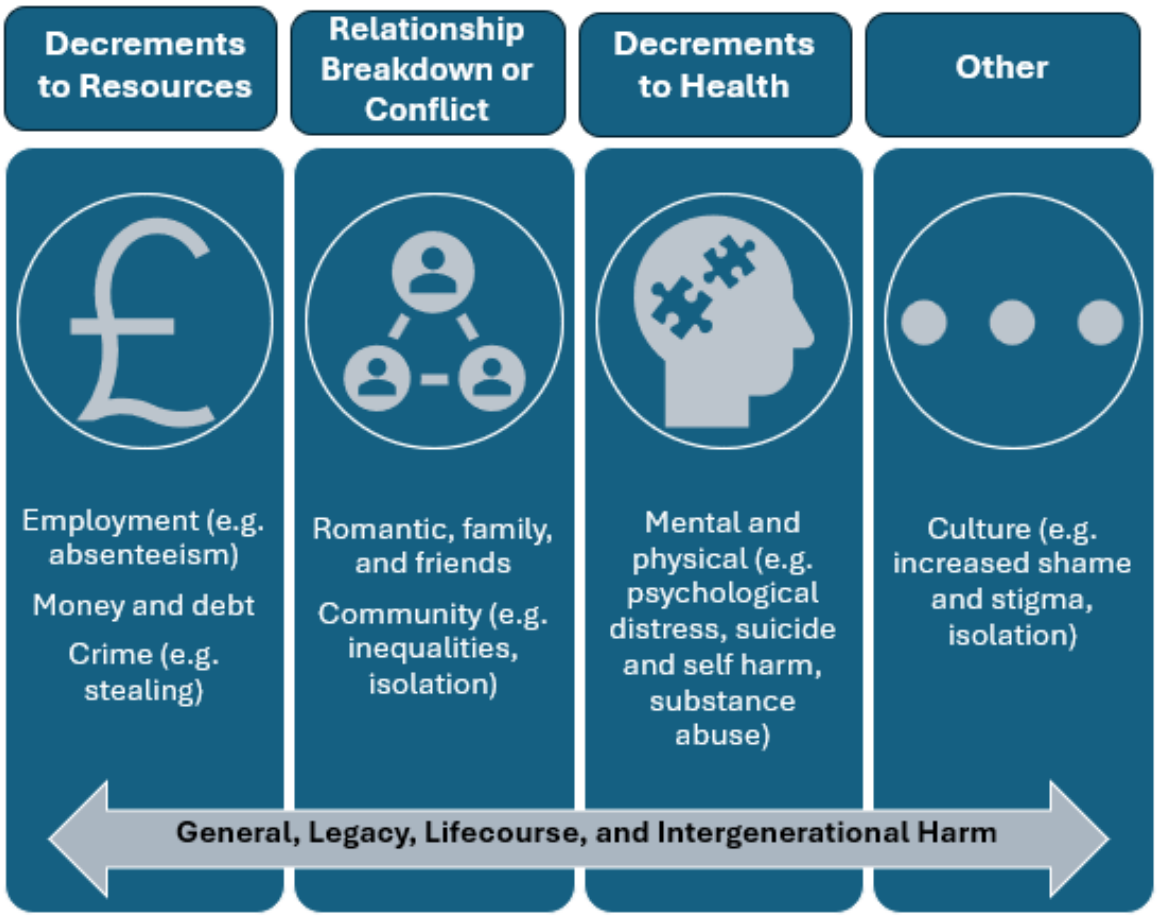

Figure 1: Types of gambling harm (based on frameworks by Langham et al., 2016 and Wardle et al., 2018)

Despite the industry narrative that gambling harms arise from a few irresponsible individuals, there is evidence from outside the UK that a large proportion of harms occur

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amongst those who do not reach the clinical threshold for gambling dependence (Browne and Rockloff, 2018). This is often referred to as the 'prevention paradox', and it highlights the need to consider the entire range of gambling behaviour when addressing its harms (Wardle *et al.*, 2024).

2.4.4 Gambling Treatment in the UK

Between 2019 and 2020, approximately 9,000 people were treated by the National Gambling Treatment Service (NGTS), a service commissioned by the charity Gamble Aware (Gamble Aware, 2020). Other charities and support groups in the UK include the National Gambling Helpline, GamCare and Gamblers Anonymous. There are currently 15 specialist gambling treatment clinics on the NHS, all of which are in England: Blackpool, Bristol, Derby, Leeds, Liverpool, London, Manchester, Milton Keynes, Newcastle, Preston, Sheffield, Southampton, Stoke-on-Trent, Telford and Thurrock (NHS England, 2024). Half of these were opened in the last year. It is anticipated that up to 3,000 people will be treated at the NHS clinics per year (NHS England, 2024). However, in 2023, The Office for Health Improvement and Disparities (OHID) reported that around 1.6 million adults who gamble in England may benefit from some form of treatment or support for harmful gambling (OHID, 2024). Around 243,000 would benefit from therapies such as Cognitive Behavioural Therapy, and almost 40,000 would benefit from intensive treatment such as residential programmes. London and the North West of England have the highest treatment needs, and the South East of England has the lowest. In England, it is estimated that 900,000 children live in a household where an adult would benefit from some form of gambling treatment. These treatment gaps are likely to be wider for Scotland, Wales and Northern Ireland where specialised NHS support is not available, and treatment relies on charities. Many of these charities are funded directly by the gambling industry, for example, Gamble Aware and GamCare (The Gambling Commission, 2024b).

2.5 Gambling on Sport

Sports betting is the most popular form of gambling in Great Britain and Northern Ireland after lotteries and scratch cards. Football is also the most popular sport to bet on in Great Britain (The Gambling Commission, 2023). The rising popularity of sports betting is likely due to a complex set of factors including technological development and the

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introduction of smartphone betting. Football betting has adapted from a discrete to a continuous activity (Killick and Griffiths, 2019; Parke and Parke, 2019; Abbott, 2020; Wardle *et al.*, 2024). This is where a player can repeatedly bet in one session, and this type of play is often associated with more risky forms of gambling such as EGMs. Football betting has increased in complexity and speed (Torrance, O'Hanrahan, *et al.*, 2023; Wardle *et al.*, 2024) with the introduction of in-play and micro-betting betting during live sports. In-play betting is a more intensive form of sports betting that allows participants to bet during a live sports game (Wardle *et al.*, 2024). Micro betting is a particularly continuous form of in-play betting that allows gamblers to bet on small, short-term, events during the game, such as a player taking a corner during a football game (Russell *et al.*, 2019); this type of gambling involves far less skill, and its outcome is determined almost immediately. Consequently, there is an increased risk of harm related to sports betting (Killick and Griffiths, 2019); the speed, frequency of play, and ease of access to a gambling product are known risk factors for gambling harm (The Gambling Commission, 2020).

2.6 Gambling as a Public Health Problem

Since gambling does not involve introducing a chemical substance into the body, there is no measurable damage to organs comparable to smoking or drinking alcohol (Korn and Shaffer, 1999). Health impacts can be for the most part psychological. Physical harms may include the health consequences of poverty from harms to financial resources. All of these are much harder to identify and measure accurately. The relationship between gambling and health is also poorly understood due to an absence of population-level data in the UK. As a result, previous approaches to gambling dependence have been psychiatric-focused (Ireland *et al.*, 2019). The effects of gambling have mostly been understood in terms of individual pathology (Wardle *et al.*, 2019), with a focus on individualised treatment interventions (Abbott, 2020) for the 'problem gambler', mirroring the industry narrative. Many researchers emphasise the value of a public health approach to gambling (Korn and Shaffer, 1999; Shaffer and Korn, 2002; Kasengele and Gillies, 2020; Blank *et al.*, 2021; Bowden-Jones and Crossley, 2021; Wardle *et al.*, 2024), to allow for the inclusion of a wider range of environmental and socioeconomic influences on gambling harms (Korn, Gibbins and Azmier, 2003). A public health

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approach would place stronger emphasis on population-based policies to prevent gambling harms (Wardle *et al.*, 2024).

A review of gambling harms by Public Health England (now OHID) concluded that gambling should be considered a public health issue due to the associated harms to individuals and society, the increasing costs to the economy, and the socioeconomic disparities in gambling-related harm (PHE, 2023). A recent Lancet Public Health Commission on gambling highlighted the threat to public health from gambling, and the need for rigorous global action (Wardle *et al.*, 2024). There is a lack of routine data collection on gambling behaviour in the UK, and its subsequent harms, unlike alcohol or smoking. For example, gambling behavioural measures have only been included in the Health Survey for England every two years since 2012, with the most recent data being from 2018. For Northern Ireland, the most recent gambling statistics date back to 2016.

2.7 The Population Approach to Policy

While a smaller proportion of the population experiences gambling dependence and may benefit from targeted treatment interventions, this person-centred approach to gambling policy fails to address the underlying determinants of gambling harm at the population level. A high-risk, treatment-focused approach requires continuous application across each generation since it is treating the symptoms rather than addressing the causes of gambling harm. On the contrary, addressing the determinants of gambling dependence and shifting the overall distribution of risk acknowledges that a larger number of people at lower levels of risk contribute a greater proportion of harm simply because they are greater in number. This principle is illustrated in Rose's paradigm (Rose, 1985). Although population-level preventative strategies may offer small gains at the individual level, they can produce substantially larger gains at the population level by targeting the full range of gamblers, not just those at the highest risk.

While a balanced policy approach that combines targeted treatment interventions with broader population-level strategies is important, much of the existing gambling research and policy discourse has been framed in terms of addressing the high-risk individual 'problem' gambler. In contrast, this thesis advocates for a population-level perspective that seeks to alter the trajectories by which people move into higher risk categories over

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time. Specifically, it emphasises the importance of addressing the environmental determinants of gambling harm. This is the rationale underpinning this thesis' focus on gambling advertising policy as a key area for public health intervention. The next section explores the landscape of UK gambling policy, with a specific focus on the regulation of gambling advertising and its comparison with international approaches.

2.8 Gambling Policy in the United Kingdom

2.8.1 Overall

Figure 2 depicts a brief overview of the development of gambling legislation in the United Kingdom. The differences for Northern Ireland will be discussed in another section of this chapter. The early history of UK gambling policy was one of regulation, particularly for the lower class (Nielson, 2020). However, the 1960 Betting and Gaming Act officially legalised betting for over 18s and allowed the opening of betting shops under the regulation of the government. Many policies which followed this aimed to control gambling activities and limit industry profits (Figure 2). However, this changed after 2005 (Banks and Waters, 2023).

2.8.2 The 2005 Gambling Act

On 1st September 2007, the Labour government implemented the 2005 Gambling Act. This replaced the 1968 Gaming Act, the 1963 Betting, Gaming and Lotteries Act, and the 1976 Lotteries and Amusements Act (The UK Parliament, 2005; Banks and Waters, 2023), entirely restructuring the gambling environment in the UK. It is now the basis for almost all gambling regulation in the United Kingdom covering: betting, casinos, bingo, arcades, society lotteries, gaming machines, and remote gambling. When implemented, it had three primary objectives (The UK Parliament, 2005):

1. To prevent crime related to gambling;
2. To allow the operation of fair gambling;
3. To protect children and vulnerable people from gambling.

This act transformed previous gambling laws, but it was largely an act of deregulation. It legalised large casinos and liberated marketing laws for gambling companies. It gave consumers increased choice of online and offline betting products and introduced gaming machines with unlimited stakes.

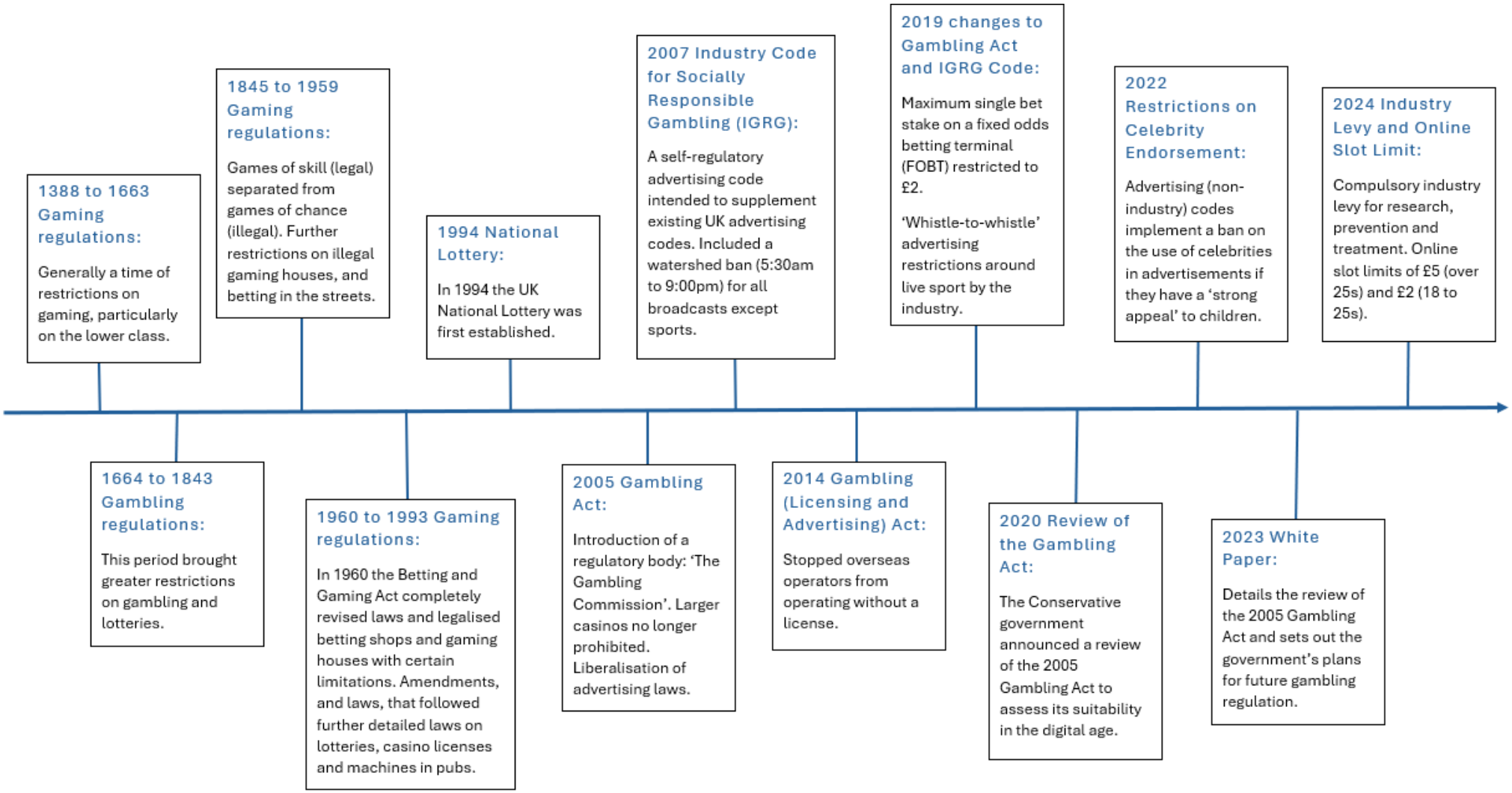

Figure 2: A timeline of gambling policy in the United Kingdom (sources: The UK Parliament, 2005; Nielson, 2020; IGRG, 2020; DCMS, 2020, 2023; CAP, UK, 2024).

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It set up an autonomous regulatory body, The Gambling Commission, to regulate the gambling industry and issue codes of practice. Quite importantly for this thesis, the act legalised television advertising for sports betting and casino products (Department for Culture, Media and Sport (DCMS), 2020). Following this, OFCOM reported a 600% rise in television advertisements for gambling products (The Office of Communications (Ofcom), 2013).

2.8.3 The 2023 Gambling White Paper

In 2020, the Conservative government initiated a review of the 2005 Gambling Act in response to concerns about its suitability in today's society. The act was established prior to major technological advances, specifically the development of smartphones, which increased accessibility to gambling. In 2023, this review detailed plans for future gambling legislation, including the introduction of a statutory industry levy to provide independent funding for gambling research (Figure 2) (DCMS, 2023). However, the review brought little change for gambling advertising policy.

2.8.4 Gambling Advertising Policy

In the UK, gambling advertising is mostly self-regulated. The Advertising Standards Authority (ASA) and Committees of Advertising Practice (CAP) restrict the content of advertising. Advertisements must be socially responsible, must not suggest that gambling can provide a solution to financial problems, and must not exploit vulnerable people, including people under the age of 18. Recently, the CAP introduced a ban on the use of celebrity endorsement in television adverts, if the celebrity has particular link or appeal to children (CAP, UK, 2024).

There is also a voluntary (self-regulatory) code of conduct created by an industry body, the Industry Group for Responsible Gambling (IGRG, 2023). This self-regulatory code, amongst other things, restricts television advertising during the day. Gambling advertisements are not permitted on television between the hours of 5:30am and 9:00pm (the *'watershed'*), unless they depict a lottery or bingo advertisement. These products are regulated separately because they are viewed as 'lower risk'. Before August 2019, sports broadcasts were also exempt from these restrictions. This meant that operators were free to advertise any products during the day around sports programmes. After August 2019, this exemption was tightened, to only include live sports broadcasts. The

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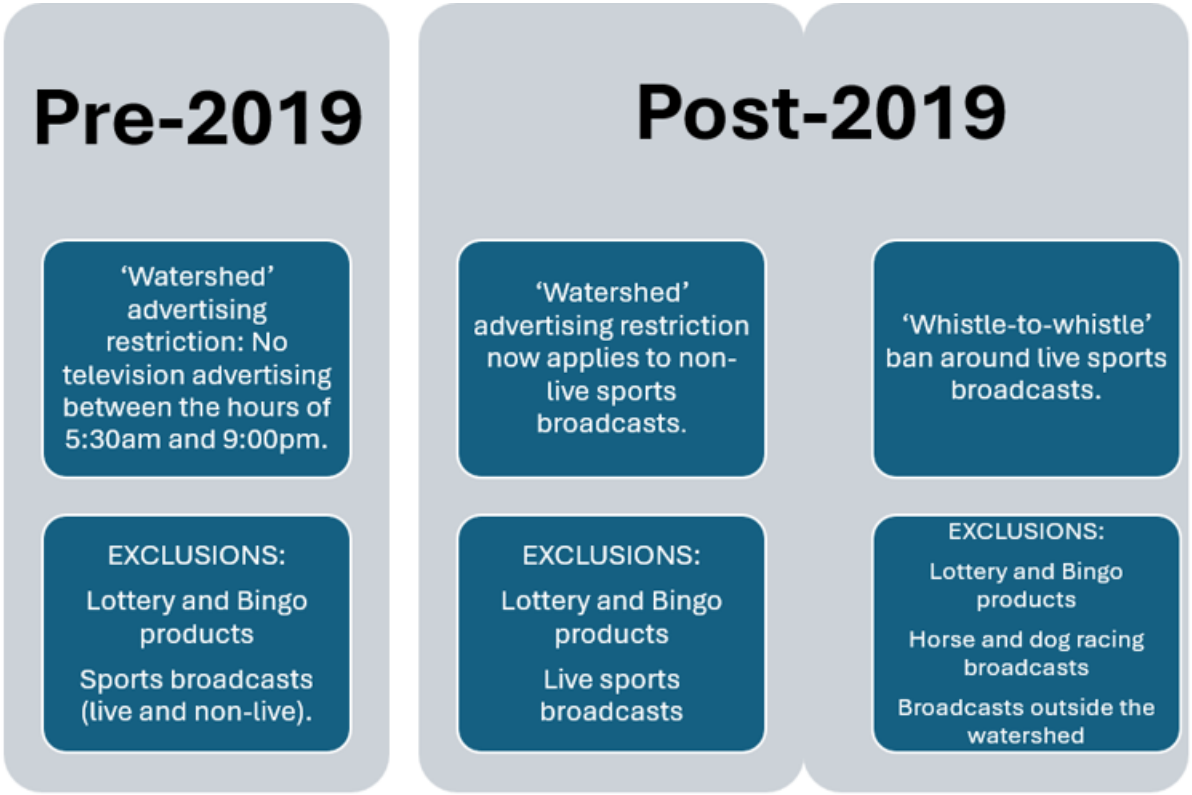
new rule meant that gambling advertisements were only allowed to be broadcast during the day if they were for a lottery or bingo product, or if they occurred around a live sports programme.



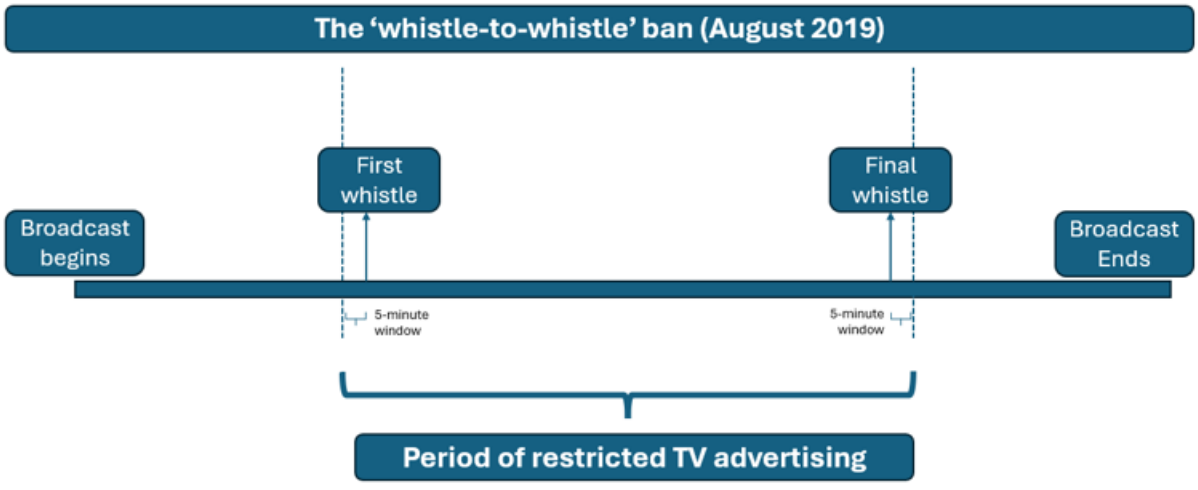


Figure 3: Industry restrictions on the scheduling of television advertising

Furthermore, advertising present during live sports programming was subject to a within-programme restriction. Television gambling advertisements could only be present in the lead up to a live game (up to 5-minutes before the first 'whistle') and after the live game

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had ended (from 5-minutes after the final 'whistle'). This essentially restricted gambling advertising on television during half-time and intermittent break periods and is known as the 'whistle-to-whistle' (W2W) ban. See Figure 3 for a graphical representation of industry self-regulation of television advertising.

2.8.5 Regulation in Northern Ireland

Gambling regulation has been a devolved matter for Northern Ireland since the 1998 Good Friday agreement. It is regulated under the 1985 Betting, Gaming, Lotteries and Amusement Order and its amended versions (The UK Parliament, 2023; Northern Ireland's All-Party Group on Reducing Harm Related to Gambling, 2024). As such, the Gambling Act, and the 2023 Gambling White Paper, do not apply to Northern Ireland, and Northern Ireland does not have its own regulatory gambling body; regulation is enforced by the courts, district councils, and police service (Department for Communities, 2024). However, the Parliament of the United Kingdom reserves the right to legislate over certain matters, including advertising; these are known as *'reserved matters'*. Advertising falls under the jurisdiction of DCMS rather than the Northern Irish devolved powers. As such, the ASA and CAP regulate advertising for the entire United Kingdom; the same is the case for self-regulation by the industry, and communication services regulation by Ofcom. Recently, there have been calls for the UK government to implement restrictions on gambling advertising in Northern Ireland (Northern Ireland's All-Party Group on Reducing Harm Related to Gambling, 2024).

2.9 Gambling Advertising Policy in an International Context

Relative to other European nations, the UK's approach to regulating gambling advertising is notably more lenient (Wilson *et al.*, 2024; Marionneau *et al.*, 2025). For example, Italy and Latvia enforce complete, or near complete, statutory bans on gambling advertising, while Belgium, Bulgaria, Estonia, Lithuania, the Netherlands and Spain impose partial statutory bans.

However, there are many similarities between the UK and neighbouring regions. Across Europe, there are widespread restrictions on the content of gambling advertisements. These include restrictions like those enforced by the ASA and CAP which, among other things, prohibit portrayals of gambling as taking priority in life or being a solution to financial problems (The Committees of Advertising Practice, UK, 2024). Almost all

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European countries enforce a ban on targeting gambling advertising towards children and young people, and approximately half prohibit targeting advertising towards self-excluded individuals, including the UK (Marionneau *et al.*, 2025; The Gambling Commission, 2025). These are individuals who have voluntarily excluded themselves from gambling activities due to experiencing gambling-related harms. Furthermore, Germany and the Netherlands ban cross-advertising (the advertising of products besides the one being used) on gambling websites. Similarly, in May 2025, the Gambling Commission introduced a new opt-in requirement, where consumers must explicitly consent to receive advertising by product, to address concerns over cross-selling highlighted in the Gambling White Paper (Department for Culture, Media and Sport (DCMS), 2023; The Gambling Commission, 2025).

Unlike the UK, some countries implement statutory broadcasting regulations beyond those that limit the content of advertisements (Marionneau *et al.*, 2025). In Spain, gambling advertising is only permitted on TV between 1am and 5am and cannot occur in a 30-minute window around children's programming (Belgium applies a 15-minute window). Some countries limit the volume of advertisements, such as in Belgium where only one sports gambling advertisement is permitted per commercial break. Also in Belgium, a full sponsorship ban is due to be implemented in 2027, with restrictions on the size and placement of sponsor logos on sports kits being implemented in the meantime. In Spain, sponsorship is prohibited altogether. In the Netherlands, online gambling advertising is only permitted if at least 95% of the audience is over 25. Several countries including France, Germany, Ireland, Portugal and Spain have specific restrictions on influencer and affiliate marketing. In Spain, social media advertising can only target channel followers, existing customers, or those who show an 'active interest' in gambling. Belgium, the Netherlands, and Switzerland impose limits on using customer data for personalised advertising. Most European countries require warning labels on gambling advertisements. However, unlike many European counterparts where these requirements are legally mandated, the UK relies on industry self-regulatory codes (Industry Group for Responsible Gambling, 2023) to govern safer gambling messages and age restriction labels.

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Overall, the UK enforces far fewer restrictions on gambling advertising than most European countries. Similarities in regulation across Europe suggest a trend of countries adopting legislation from their neighbours, often described as 'copy and paste' policies (Dolowitz and Marsh, 1996; Marionneau *et al.*, 2025). Yet, the UK's laws appear closer to some countries in central Europe, such as Hungary and Slovakia, where regulation tends to be more lenient.

Beyond Europe, some regions exhibit even more relaxed policies. For example, following the repeal of the Professional and Amateur Sports Protection Act in 2018, (Nelson *et al.*, 2019; Hollenbeck, Larsen and Proserpio, 2024), the USA has seen an increased spend on gambling advertising (American Gaming Association, 2024). Similarly to the UK, gambling advertising is permitted in Australia with few restrictions (Wilson *et al.*, 2024). One of those restrictions, however, is a legally mandated 'whistle-to-whistle' ban which includes not only TV advertising, but all commentary and radio advertising too (The Australian Communications and Media Authority, 2021). Furthermore, there have been recent calls in Australia to impose a phased blanket ban on gambling advertising over the next three years (Parliament of Australia, 2023). In another context, across Sub-Saharan Africa, only 43% of countries have legislation explicitly addressing advertising (Sichali *et al.*, 2023).

There is limited research on the implementation, enforcement, and impact of gambling advertising policies across the globe. One study suggests that Spanish restrictions may have reduced the impact of advertising spend on gambling behaviour, except for bonus promotions (García-Pérez, Krotter and Aonso-Diego, 2024). Recent reports suggest that Italy may reconsider its blanket ban on gambling sponsorship, and concerns have been raised about the effective enforcement of restrictions in Belgium (Constandt and De Jans, 2024; De Jans, Hudders and Newall, 2024).

An international study comparing the prevalence of gambling problems across countries with varying levels of advertising policies found a significant negative effect related to online restrictions only (Planzer, Gray and Shaffer, 2014). However, simply comparing rates of 'problem gambling' across jurisdictions is challenging due to the many drivers of these rates besides advertising. At the time of the study, most countries had few, or no, advertising restrictions making it harder to understand the differences. Moreover, many

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countries follow a trajectory from market liberalisation leading to increased gambling, advertising, and harm, followed by policy responses (Wilson *et al.*, 2024), so it can be difficult to disentangle the effects. Although the effects of advertising liberalisation across the USA remain understudied, the broader easing of sports gambling laws, which includes the relaxation advertising laws, has been linked to deteriorating financial health including increased levels of debt (Hollenbeck, Larsen and Proserpio, 2024).

2.10 Gambling Advertising

2.10.1 Definition of Gambling Advertising

The Oxford English Dictionary defines advertising as the publication of an announcement through a public channel. Other terms used in the gambling advertising literature are marketing (promoting or selling a product) and promotion (the publicising of a product or an organisation to increase public awareness or sales) (Oxford University Press, 2013). These terms are often used interchangeably in the literature to define different things. To account for this lack of definitional clarity, this thesis takes a broad definition which accounts for all types of advertising, marketing, and promotion of gambling including: traditional (TV, radio and print), digital (online, social media), direct messaging (e.g. emails and texts), embedded (e.g. sponsorship, pitch-side hoardings, commentaries during live sports), and specific inducements (e.g. free bets). Where the word advertising is used in this thesis, it refers to all of the above, unless the specific type of advertising is named. This definition is described in more detail in Chapter Three. The majority of gambling advertising research can be split into two types: content, frequency, and expenditure analyses, and studies exploring the impact of advertising on gambling behaviour.

2.10.2 Gambling Advertising and Gambling Harm

Gambling advertising may contribute to gambling-related harm by influencing gambling behaviour and several mediating factors. Figure 4 presents a causal loop diagram, illustrating advertising as the exposure variable, gambling as the behavioural variable and several potential harms and mediating pathways. This is a purely speculative model in the absence of an established model that outlines an exhaustive list of mediator variables between gambling advertising, behaviour, and harm.

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Financial harm is directly linked to gambling behaviour through its impact on personal financial resources. These financial harms can, in turn, trigger secondary harms, such as mental health issues, resulting from severe psychological distress, or criminal harms, resulting from severe financial distress, including bankruptcy. Financial difficulties may result in secrecy, which can mediate relationship harms, including arguments and the breakdown of a relationship.

However, not all gambling-related harms arise solely through financial ones. Gambling is highly stigmatised in society and therefore gambling-related shame and guilt can result in mental health harms such as psychological distress and anxiety. This stigma can also foster secrecy within relationships, contributing towards relationship harms. Time spent gambling is another significant mediator for harms. Loss of time can directly impact employment through absenteeism or poor work performance and can also harm physical health by disrupting sleep. Distraction at work, caused by the time spent gambling, may lead to significant consequences, such as job loss, which further exacerbates financial harms through a loss of income.

When financial harm becomes severe, potentially resulting in criminal behaviour, this can lead to job loss and longer-term financial burden. Legal repercussions through the Proceeds of Crime Act (POCA) include the repossession of personal property and the long-term repayment of debts. These can extend beyond the gambler themselves, affecting their family and friends, even if they were unaware of the fraudulent activity (The Commission on Crime and Gambling Related Harms, 2023).

While sports-related gambling advertising has the potential to contribute to harm through the same mechanisms described above, it may also function as a ‘gateway’ into more harmful forms of gambling, or those associated with higher PGSI scores (Public Health England (PHE), 2023; The Gambling Commission, 2024d). Presenting gambling within a sporting context can normalise it and diminish its perceived risks (McGee, 2020; Killick and Griffiths, 2023). After signing up to a sports betting platform, individuals may then be exposed to a broader range of gambling activities, including online casinos, which are associated with higher rates of gambling harm (Public Health England (PHE), 2023; The Gambling Commission, 2024d). These forms of gambling tend to carry higher risk, and as a result the harms may be more severe and enduring.

Figure 4: A causal loop diagram of gambling harms and their mediating variables

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2.10.3 Gambling Advertising Research

2.10.3.1 Content, Frequency, and Expenditure Studies

Studies looking at the frequency and content of gambling advertising indicate that advertising is widespread, centred around sports (Deans *et al.*, 2016; Newall *et al.*, 2019; Torrance *et al.*, 2021), and often over-represents complex, riskier, bets (Newall *et al.*, 2019; Torrance *et al.*, 2021). Gambling advertising almost always presents the activity as a win (Deans *et al.*, 2016; Torrance *et al.*, 2021), and commonly uses celebrity endorsement (Milner *et al.*, 2013; Deans *et al.*, 2016); a practice that has recently been restricted by the CAP. Advertisements often portray authority and confidence (Milner *et al.*, 2013). They are predominantly targeted towards young males (Milner *et al.*, 2013; Deans *et al.*, 2016), and depict gambling as a male-dominated, low-cost, high return activity, which is associated with celebrations (Lopez-Gonzalez, Guerrero-Solé and Griffiths, 2018). A study by Cassidy and Ovenden (2017) identified 764 instances of gambling advertising during three 'Match of the Day' episodes. Gambling references are most common in boxing (4.7 per minute) and football (2.75 per minute) (Purves *et al.*, 2020). Gambling advertising is more prevalent than alcohol advertising across matchday programmes (Sharman, Ferreira and Newall, 2020). During the 2020 men's Euros football tournament, there were an average 4.5 of gambling advertisements on television per-live match, mostly depicting financial inducements, brand awareness, and specific odds (Newall, Ferreira, *et al.*, 2022). Comparably, during the 2022 World Cup this figure was 5.2 per live game (Sharman *et al.*, 2023). Embedded advertising during live sport is also highly prevalent (Purves *et al.*, 2020; Rossi *et al.*, 2023; Torrance, Heath, *et al.*, 2023). Research has shown that the greatest exposure to gambling advertising is through television advertisement (IPSOS Mori, 2020; Dunlop and Ballantyne, 2021; Syvertsen *et al.*, 2022), highlighting it as an important area for further research. Studies have identified digital advertising as having greater exposure and particular appeal to children and young people (Guillou-Landreat *et al.*, 2021; Singer, Wöhr and Otterbach, 2024).

Other studies have looked at expenditure on gambling advertising. Earlier research suggested that between 2014 and 2018 spend on gambling advertising increased by 17% per-year. Spend rose the most for online (23% per-year) and television (15% per-year) advertising. In particular, sports television advertising expenditure rose by 22% per-year

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(Regulus Partners, 2018). More recent research finds that advertising expenditure decreased during the initial COVID-19 lockdown, only to increase in the second and third lockdown periods. Expenditure during later lockdown periods was around 5% higher than pre-lockdown levels (Critchlow *et al.*, 2023).

2.10.3.2 Studies Exploring the Impact of Gambling Advertising on Behaviour

2.10.3.2.1 All Types of Advertising

A systematic review and meta-analysis (Bouguettaya *et al.*, 2020) reports that gambling advertising has a positive impact on gambling attitudes, intentions and behaviours, with evidence of a dose-response effect, although meta-analysis results were statistically significant for gambling behaviour only. In a study using semi-structured interviews with 18-28 year olds, Dunlop and Ballantyne (2021) cited advertisements as being the prime reason for opening a betting account. Individuals with a gambling disorder have reported that advertisements may act as a trigger to gamble (Grant and Kim, 2001; Griffiths, 2005; Binde, 2009; Hanss *et al.*, 2015), prompting their cravings and making it harder abstain (Binde, 2009). So, advertising may signify a means of engaging vulnerable people, or it may act as a trigger for relapse for those experiencing gambling dependence. Quasi-experimental studies have indicated that television advertising is positively associated with lottery sales after taking the size of the jackpot into account (Heiens, 1999), other studies find effects for TV and radio with long-lasting impacts on sales (He and Klein, 2023). Furthermore, the liberalisation of gambling in Macau and subsequent increased accessibility to, and advertising for, gambling was found to relate to increased gambling behaviour, particularly amongst younger, higher-risk gamblers (Ho, Wong Sau-kuen and Man-chun, 2012). A systematic review of gambling sponsorship identified that sponsorship is widespread, particularly in sports where it can promote gambling as a lower risk activity. Children are particularly able to identify and recall gambling sponsors (De Jans, Hudders and Constandt, 2024). Despite this evidence, there exists very few experimental, quasi-experimental, and longitudinal studies.

During my PhD, I undertook some external work for the Greater London Authority to inform a potential policy on gambling advertising on the Transport for London network. This involved completing a review of systematic reviews on the relationship between gambling advertising and gambling behaviour, and the potential for gambling harms (E.

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McGrane *et al.*, 2023). This umbrella review confirmed that gambling advertising increases gambling behaviour, and it may disproportionately impact those already more vulnerable to harm. Additionally, it can normalise betting for children and young people, and encourages them to want to take up betting in the future.

2.10.3.2.2 Sports-Related Advertising

The presence of unhealthy products in healthy industries is not a new phenomenon (Wardle *et al.*, 2024). This juxtaposition existed for tobacco products until the 2003 sponsorship ban (The UK Parliament, 2002), and still exists for alcohol, with Guinness recently announcing a four-year partnership with the Premier League (Sky News, 2024). Gambling is no exception, with gambling shirt sponsorship in the Premier League rising from 40% to 60% of teams between 2023/24 and 2024/25 seasons. Football teams have agreed to a ban on front-of-shirt advertising for gambling due in the 2025/2026 season (*BBC Sport*, 2023). This ban does not apply to sponsors present on the sleeves of shirts, where there is currently only one gambling sponsor present (Crystal Palace). This widespread advertising around sport is often referred to as the *'gamblification'* of sport (McGee, 2020; Macey and Hamari, 2022; Hing, Rockloff and Browne, 2023).

Whilst undertaking the systematic review in Chapter Three of this thesis, a similar review was published. This review focused on the behavioural impact of advertising related to sports, and its results corroborated those of the broader systematic reviews above (Killick and Griffiths, 2022). However, this review did not include studies on children, or grey literature; it's searches only covered studies up to 2019. Therefore, I completed an up-to-date and more comprehensive systematic review which will be described in detail in Chapter Three.

2.10.4 Evidence for Public Support of Gambling Advertising Restrictions

In Great Britain, the general public support restrictions on gambling advertising. In a 2012 YouGov survey, 73% of people responded that gambling should not be advertised on television (YouGov, 2012). This was higher than alcohol and almost comparable to cigarettes. This opinion is unchanged in 2024. Around 72% of the public agree that there needs to be tougher regulations around gambling advertising on television, comparable to social media (74%) (Ipsos, 2024). The same report stated that a quarter of respondents

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who had gambled in the last 12 months had done so after viewing a gambling advertisement, and this rose to over three quarters in people with a Problem Gambling Severity Index Score over 8 (experiencing 'problem' gambling). The same Ipsos report showed that half of higher-risk individuals would find it difficult to watch a football game without wanting to place a bet due to advertising. Another report indicated that 2 in 3 football fans believe that there are too many gambling advertisements in football (Opinium Research, 2022).

2.10.5 Comparison to Other Commercial Determinants of Health

There is much to be learned from other areas of health research, particularly where there are evidence gaps in gambling research. Exploring quasi-experimental literature, of which there is a scarcity in gambling advertising research, is useful to help us understand how policies might impact behaviour in real life. It is also useful to compare the policy landscape, and how it has influenced addictive behaviours, across other unhealthy commodities.

2.10.5.1 Tobacco

Research suggests that tobacco advertising increases tobacco consumption (Tye, Warner and Glantz, 1987; Anderson, Duckworth and Smee, 1992; Saffer and Chaloupka, 2000). Tobacco advertising is associated with increased likelihood of smoking amongst young people (Lovato *et al.*, 2003), and countries with 'Point of Sale' tobacco advertising bans have lower youth smoking participation rates (Shang *et al.*, 2016). Comprehensive advertising bans are more successful compared to a limited set of restrictions which most likely lead to substitution rather than reductions in advertising expenditure (Saffer and Chaloupka, 2000; WHO, 2003). Decades following the discovery of a causal link between cigarette smoking and cancer (Proctor, 2012), the World Health Organization (WHO) implemented the Framework Convention on Tobacco Control (WHO, 2003). This recommended a comprehensive ban on tobacco advertising, promotion and sponsorship to reduce tobacco consumption. Since this framework, the UK have implemented a comprehensive ban on tobacco advertising which has resulted in significant reductions in exposure to pro-tobacco marketing (Harris *et al.*, 2006), again highlighting the success of comprehensive advertising bans.

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2.10.5.2 Unhealthy Food and drink

A commodity facing slightly fewer restrictions than tobacco is unhealthy food and drink. Research has suggested that advertising of unhealthy food tends to be highly prevalent in areas of low socioeconomic status, and that there is evidence for the influence of exposure to advertising on unhealthy eating and obesity (Chung *et al.*, 2022). Backholer *et al.* (2021) present strong evidence that children from lower socioeconomic backgrounds and ethnic minority groups are disproportionately exposed to unhealthy food advertising, with this exposure linked to unhealthy dietary behaviours and subsequent weight gain. Advertising policies might also reduce purchasing of unhealthy foods in children and young people (Boyland *et al.*, 2022).

In the UK there are several examples of restrictions on advertising for unhealthy food and drink. In 2019, a 'junk food' advertising ban was implemented on the Transport for London (TfL) network. An analysis of this ban found that it resulted in diminished growth in consumption of fat, saturated fat, and sugar (Yau *et al.*, 2022). Furthermore, TfL experienced a 2.8% increase in advertising income despite the ban being in place (Chung *et al.*, 2022). In 2021, Bristol followed suit, introducing a ban on this type of advertising across council-owned advertising space (Scott *et al.*, 2023). The ban also included restrictions on other unhealthy commodities (gambling, alcohol and payday loans). Preliminary data suggested that advertising before the ban was highly prevalent and more often observed by younger people in more deprived areas, suggesting that the ban might reduce health inequalities (Scott *et al.*, 2023). However, non-significant changes in consumption and purchasing of unhealthy foods were reported in an evaluation study; this might be due to the nature of the policy which only covered council owned outdoor advertising, approximately 30% of all outdoor advertising (Buckland *et al.*, 2024). Finally, in October this year, a ban on junk food advertising online and on television before 9pm is due to be implemented in the UK: a measure aiming to address childhood obesity (DHSC, 2024).

2.10.5.3 Alcohol

Research indicates that alcohol advertising is highly prevalent during sports tournaments in the UK and Europe (Purves *et al.*, 2017; Purves and Critchlow, 2021). Advertising for alcohol is associated with increased intentions to drink, the likelihood of

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drinking, and the consumption of alcohol in young people (Anderson *et al.*, 2009; Smith and Foxcroft, 2009; Critchlow *et al.*, 2019; Giesbrecht, Reisdorfer and Shield, 2024). Noel, Sammartino and Rosenthal (2020) indicate that engaging with alcohol advertising, such as clicking on a link or sharing a post on social media, is positively associated with alcohol consumption and hazardous drinking behaviours. Other studies have identified digital marketing as being potentially important (Critchlow *et al.*, 2016). A review by Jernigan *et al.* (2017) found a positive association between youth exposure to alcohol advertising and levels of alcohol consumption, initiation of alcohol use, and hazardous drinking behaviours. Similarly, (Finan *et al.*, 2020) corroborates this in samples of adolescents and young adults. Sargent and Babor (2020) argue that this relationship is causal based on the Bradford Hill causality criteria. A study using alcohol industry case studies indicates the effectiveness of campaigns in increased consumption-related outcomes, targeting vulnerable groups, and for causal effects in this relationship (Maani Hessari *et al.*, 2019). More recent evidence suggests that alcohol advertising might act as a trigger for people in recovery from alcohol dependence (Murray *et al.*, 2024).

Alcohol is perhaps the most comparable commodity to gambling, in terms of its advertising policy landscape. In the UK, alcohol advertising is self-regulated in a similar way to gambling advertising, and academics have identified how this approach is failing vulnerable people (Noel, Babor and Robaina, 2017; Boniface *et al.*, 2023). The World Health Organisation recommends comprehensive advertising restrictions for alcohol as a 'best buy' policy (WHO, 2018). Despite there being advertising restrictions in place in other countries (Boniface *et al.*, 2023), adherence is often incomplete. In France, alcohol brands have been able to advertise during the 2016 men's Euros football tournament (Purves *et al.*, 2017), and the 2022 men's World Cup (Movendi International, 2022), despite a law restricting alcohol advertising and prohibiting sponsorship. This is due to the use of 'alibi marketing' which is an indirect form of advertising using similar colour, font and logos to standard direct marketing (Purves *et al.*, 2017).

2.11 Motivation for this Thesis

As suggested in this chapter, gambling is an important public health problem, given its wide-ranging health and social harms. Outdated legislation in the UK, coupled with the development of smartphone betting, make it a critical area of public health importance

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where additional research is required to inform evidence-based policy. Evidence suggests that advertising may be an important risk factor for gambling harm, and widespread advertising since the 2005 Gambling Act, alongside self-regulation of advertising by the industry, make it an interesting topic for research. Public opinion supports restrictions on gambling advertising and emphasises the important effects of gambling advertising around live sport (Ipsos, 2024). Television advertising is an interesting case given that it is one of the most prevalent routes of exposure to advertising (IPSOS Mori, 2020; Dunlop and Ballantyne, 2021; Syvertsen *et al.*, 2022), and it is subject to industry self-regulatory scheduling requirements in the UK (IGRG, 2023). To date, there has been no comprehensive evidence for the impact of these self-regulatory mechanisms on the presence of advertising on television. There is also a paucity of experimental evidence for the effect of gambling advertising on gambling behaviour, particularly television advertising. Such evidence is needed to assess the implications of self-regulation and to inform future gambling policy. This is especially important given the evidence that comprehensive bans are more effective than partial bans for other unhealthy commodities (Saffer and Chaloupka, 2000; World Health Organisation, 2003, 2018; Harris *et al.*, 2006). A recent Lancet public health commission on gambling encouraged placing increased emphasis on population-based approaches to gambling policy, including restricting exposure to gambling advertising (Wardle *et al.*, 2024). Therefore, this thesis aims to fill a vital evidence gap by exploring the impact of restrictions on television gambling advertising in the UK.

2.12 Thesis Aim

To explore the impact of restrictions on gambling advertising on television in the UK, with a particular focus on live sports.

2.13 Research Questions

1. What is the impact of sports-related gambling advertising on gambling behaviour (Chapters Three to Six)?
    i. *What is the existing quantitative evidence for the impact of all types of sports-related gambling advertising on gambling behaviour (Chapter Three)?*

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   ii. *What is the impact of television advertising around live sports on sports betting behaviour (Chapters Four to Six)?*

2. What is the impact of existing restrictions on advertising around live sport on the presence of gambling advertising on television (Chapters Seven to Eight)?
   i. *How did television advertising around live football broadcasts change after the introduction of the 'whistle-to-whistle' ban on gambling advertising in August 2019 (Chapter Seven)?*
   ii. *How did television advertising across the rest of the UK television network change after the introduction of the 'whistle-to-whistle' ban on gambling advertising in August 2019 (Chapter Eight)?*

2.14 Chapter Conclusion

This chapter has outlined the background and motivation for this thesis. The next chapter presents a systematic review of the evidence for the relationship between sports-related gambling advertising and gambling behaviour, highlighting some primary evidence gaps that this thesis will address.

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Chapter Three: What is the impact of sports-related gambling advertising on gambling behaviour? A systematic review

This chapter presents the results from a systematic review exploring the impact of sports-related gambling advertising on gambling behaviour, both as defined in this chapter. It follows PRISMA guidelines and provides the most up-to-date and comprehensive review of the evidence. The Version of Record of this manuscript has been published by Wiley and is freely available in *Addiction*:

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 Its subsequent Appendix is detailed in Appendix 1 of this thesis; all tables and figures in this appendix are labelled according to the pdf.

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There are five co-authors on this paper. The contributions of all authors, using the Contributor Role Taxonomy (CRediT), are detailed below:

Ellen McGrane: EMc led the conceptualisation, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, and writing of the original draft, and reviewing and editing the draft for publication.

Elizabeth Goyder (primary supervisor): EG led the supervision, and supported the conceptualisation, formal analysis, investigation, methodology, project administration, writing of the original draft, and reviewing and editing the draft for publication.

Robert Pryce (secondary supervisor): RP supported the supervision, methodology, project administration, writing of the original draft, and reviewing and editing the draft for publication.

Matt Field (third supervisor): MF supported the supervision, methodology, project administration, writing of the original draft, and reviewing and editing the draft for publication.

Esther Moore: EMo supported the formal analysis, methodology, writing of the original draft, and reviewing and editing the draft for publication.

Shangshang Gu: SG supported the formal analysis, methodology, writing of the original draft, and reviewing and editing the draft for publication.

This review includes studies published up to February 2024. Whilst no new important studies have been identified since this chapter was published, additional relevant studies published after this date, but before the completion of this thesis, have been identified using scoping searches and Google alerts with the search terms detailed in the systematic review manuscript. Although several new studies emerged in the broader area of gambling advertising, sports-specific studies were limited.

Two new studies were identified, neither of which contributed novel methodologies, and both were broadly in line with the findings from this systematic review. One study employed primarily descriptive methods to examine the relationship between in-app sports gambling advertisements and gambling behaviours. Their findings support the

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conclusions of this review, highlighting a positive association between mobile app promotions and perceived influence on sports betting. This study also extend the evidence base to a new setting, Nigeria (Ezema, Oparaugo and Onyebuchi, 2025). The second study employed hierarchical regression to investigate the predictive role of sports betting advertising on PGSI scores among 18–24-year-olds. While the actual quantity of advertising exposure was not a significant predictor, other advertising-related variables, such as the likelihood of betting decisions being influenced by advertising and the perceived impact of inducements, were both positive and significant predictors of PGSI score (Di Censo, Delfabbro and King, 2024).

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REVIEW

ADDICTION SSA

What is the impact of sports-related gambling advertising on gambling behaviour? A systematic review

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Abstract

Background and Aims: Gambling is a public health issue and widespread advertising of gambling products may contribute to gambling harms. Sports-related gambling advertising includes advertising around sports games or for sports betting products. This review aimed to provide the most systematic and up-to-date review of the literature on the association between sports-related gambling advertising and gambling behaviour.

Methods: A systematic literature search of quantitative studies up to 13 February 2024 was undertaken following PRISMA guidelines. Inclusion criteria were quantitative studies published in the English language exploring the association between sports-related gambling advertising and gambling behaviour. Traditional database searches (Medline, Scopus, PsychInfo, Web of Science, CINAHL and The Cochrane Library) were undertaken alongside citation, author and website searches. Studies were narratively synthesised, and the overall quality of the evidence was assessed using the Mixed Methods Appraisal Tool (MMAT).

Results: Twenty-two studies were included in this review covering traditional, digital, direct, embedded, inducement and aggregate advertising. The majority (n = 16) of research was undertaken in Australia on adult populations. Results suggest that sports-related gambling advertising is associated with increases in perceived, intended and actual frequency of (n = 6 studies) and expenditure on (n = 3) gambling, unplanned or unintended gambling (n = 2), the likelihood of gambling (n = 2), the likelihood of using a sponsor's product (n = 2) and, in some cases, the complexity or riskiness of bets placed (n = 2). Studies suggest that the self-reported effect may be more pronounced in higher-risk gamblers (n = 7). Preliminary evidence suggests that specific inducements which reduce the riskiness or cost of gambling appear to be particularly influential (n = 3). Limitations of the evidence base include the lack of standardised measures and use of observational designs.

Conclusions: Exposure to sports-related gambling advertising appears to be associated with increased gambling behaviour for a wide range of advertising media. This association may be more pronounced in higher-risk gamblers who are already at increased risk of harm.

KEYWORDS
advertising, behaviour, gambling, policy, public health, sports, systematic review

INTRODUCTION

Gambling advertising has attracted the interest of researchers and policymakers world-wide, with studies citing its widespread and highly targeted nature [1, 2]. Rapid technological change over the last 20 years has increased accessibility to gambling [3]. Advertising has mirrored this trend, increasing in frequency and complexity [1, 2]. The potential increase in harms has garnered the attention of public health stakeholders. Harms from gambling can occur to the individual, affected others (e.g. family or friends) and to wider society [4, 5]. These encompass harms to resources (e.g. employment or debt), relationships (e.g. family or partner), health (physical or mental) [4] and other aspects (e.g. criminal or cultural) [5]. Harms may continue after individual gambling ceases; referred to as 'legacy harms' [5]. Consequently, gambling has been identified as a public health problem [6–10]. The impact of gambling advertising on gambling behaviour and subsequent harms has been the focus of research in recent years. The association between sports and gambling has received significant attention, with studies citing widespread prevalence on television, pitch-side hoardings and via sponsorship deals [1, 2, 11–14].

There are existing reviews on gambling advertising and its direct relationship with behaviour. A review [15] concluded that gambling advertising positively increases gambling attitudes, intentions and behaviours; the latter being statistically significant in a meta-analysis. There is some evidence of a dose–response effect, whereby increased exposure to advertising is associated with an increasing effect on gambling behaviour. An umbrella review [16] and a review in the sporting context [17] identified similar results.

Despite the strong contributions of existing reviews, searches only go up to 2021 [15–17]. Two of these reviews take a broad approach, exploring the impact of all types of gambling advertising on behaviour [15, 16]. However, sports-related advertising has received particular attention because of its widespread nature, potential to normalise gambling and create a gateway to gambling harm [18–20]. An existing, more focussed, review on this topic does not include studies on children or grey (unpublished) literature [17]. Including grey literature in a systematic review can help to minimise publication bias and foster a more balanced view of the evidence base [21, 22]. Given that public health research on gambling is less well-developed compared to alcohol and tobacco, examining the grey literature may be important for obtaining a more thorough understanding of the evidence base.

There are other systematic reviews that focus on adjacent topics, such as the type of marketing strategies used by the gambling industry [23]. However, there has been no updated comprehensive systematic review exploring the direct association between sports-related gambling advertising and gambling behaviour. In this review, sports-related gambling advertising includes advertising around sports games or for a sports betting product. For example, generic gambling brand logos on football shirts or social media advertisements for horse racing products. Behaviour encompasses all types of gambling providing it occurs in response to a sports-related advertisement, as defined above.

Given the rapidly expanding evidence base and policy relevance of this research area, an in-depth and up-to-date review would be valuable for policy stakeholders. A review of the 2005 Gambling Act [24] permitted the continuation of self-regulation of advertising, including sport sponsorship, which was left to the discretion of sporting bodies. Current self-regulatory policies permit advertising around live sports games [25]. Understanding the evidence for the impact of sports-related gambling advertising on gambling behaviour is vital to understanding how such policy decisions impact gambling behaviour and subsequent gambling harms. In particular, the use of quantitative evidence in public health economic models, such as those used for alcohol [26], can help to forecast the impact of policy decisions on behavioural and health outcomes and associated costs.

Aim

This review aims to provide the most systematic and up-to-date review of the quantitative literature on sports-related gambling advertising and its association with gambling behaviour.

METHODS

Search strategy

A systematic literature search of studies measuring the direct association between sports-related gambling advertising and gambling behaviour was undertaken following Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines. The protocol and any amendments can be found on Prospero (CRD42024509195). Following preliminary searches several keywords were identified: (Gambl* OR bet OR wager OR stake) AND (advert* OR ad OR market* or promot* OR sponsor*) AND (sport* OR foot* OR soccer OR AFL OR rugby OR cricket OR racing OR horse OR boxing) AND behavio*. The full search was completed on 13 February 2024 using several research databases: Ovid (Medline, Scopus, PsychInfo, Web of Science, CINAHL) and The Cochrane Library. Supplementary searches were undertaken: citation, author and web-site searches, in addition to any other studies known to the lead author. The methods of grey literature searching align with those recommended in the literature, specifically using Scopus and websites of relevant organisations and funding bodies [21, 22]. Title and abstracts were inspected by the lead reviewer in Microsoft Excel twice. Two additional reviewers (S.G. and E.C.M.) screened a random 20% of search results (a total of 40%) and any queries were discussed until agreement was reached.

Inclusion criteria

The inclusion criteria were: (1) quantitative studies; (2) looking at the relationship between sports-related gambling advertising and gambling behaviour; (3) related to any sport; (4) in any population; (5) in any country; (6) published up to 13 February 2024; and (7) in the English language or with an English language translation.

Exclusion criteria

Exclusion criteria included: (1) qualitative studies; (2) literature or systematic reviews; (3) studies focussed on non-sports-related advertising; (4) studies that looked at indirect (mediating) effects or mechanisms of effects; (5) content or frequency analysis studies; (6) studies focusing on safer gambling advertising; and (7) studies not in the English language or with no English language translation. The authors acknowledge the valuable contribution of qualitative research in this area. However, qualitative literature was excluded from this review given it primarily focuses on underpinning mechanisms (such as the reasons why behaviour might change in response to advertising). The current review was interested in the direct behavioural impact of advertising and not why it occurs. Articles looking at safer gambling messaging were excluded because this was perceived to be a separate research question.

Advertising definition

This review defined sports-related gambling advertising as any form of advertising by gambling companies if present during, or related to, any sport game or sports betting product. As such, the content of advertising may expand beyond sports products if it occurs in, or around, sports (e.g. on television during live sports). A bottom-up coding framework was created using the available data from the review, and results presented based on this framework:

1. Traditional (e.g. television (TV), radio, print)
2. Digital (e.g. on-line, social media)
3. Embedded (e.g sponsorship, pitch-side)
4. Direct (e.g. emails or text messages)
5. Inducements (e.g. free bets, stake-back offers)
6. Aggregated advertising or inducements (e.g. one measure of total frequency of exposure to all types of advertising)

Gambling behaviour definition

We defined gambling behaviour as any actual gambling, intent to gamble or urge to gamble, including self-reported measures. This is not controversial given that both urges or cravings and intentions to gamble are reliably associated with gambling behaviour [26–29]. We also included self-perceived impacts of advertising on gambling behaviour, but did not include other measures of the affective response to advertising (aside from urge or craving), because these are not necessarily associated with the desire to enact the behaviour.

Data synthesis

Measures used varied substantially. This somewhat reflects the difficulty in measuring the behavioural impact of advertising, and the lack of standardised measures of gambling behaviour. There is no agreed measure of a 'unit' of gambling like alcohol or smoking. Therefore, a meta-analysis was not appropriate. The considerable diversity of measures could not be overcome by simply converting effect sizes. Instead, a narrative synthesis was undertaken in which results were grouped by advertising type. A narrative summary of the included studies is provided in Table 1. The characteristics of included studies are detailed in Table 2.

Assessment of study quality

Study quality was assessed using the Mixed-Methods Appraisal Tool (MMAT). The MMAT was developed in 2006 [30], and subsequently revised [31]. It allows for the appraisal of studies in five categories of study type: (1) qualitative; (2) quantitative randomised-controlled; (3) quantitative non-randomised; (4) quantitative descriptive; and (5) mixed-methods. The MMAT was selected because it allows for assessment of descriptive studies. Quality criteria in the MMAT cover: reporting (research questions and aims), sampling (strategy, representativeness), measures (appropriateness, validity), data (suitability) and statistical methods (confounding and risk of bias). The MMAT does not have an associated scoring system and as such studies cannot be ranked or compared based on their quality level. Instead, the tool encourages the inclusion of all articles, regardless of quality, to allow for a detailed presentation of the strengths and weaknesses of the evidence base. An explanation of the type of studies included in this review is provided in Appendix A.

RESULTS

Search results

Figure 1 presents a PRISMA flow diagram citing the reasons for excluding studies at each stage. In total, 1276 articles were identified during the full systematic search of databases and exported from Zotero into Microsoft Excel. Of these, 441 duplicates were deleted using Microsoft Excel, and a further seven duplicates were deleted manually. Following the title and abstract sift, 791 articles were excluded. Of the remaining 37 studies, 35 were extracted successfully by the lead reviewer (E.M.) and two were excluded as they were not

TABLE 1 Broad narrative summary of included studies.

No.	Authors	Year	Study type (MMAT)	Advertising type	Summary	Strengths	Limitations
1	Houghton and Moss [38]	2020	Experimental	Digital	This article uses an experimental design to measure individual likelihood of betting, expenditure and confidence in bets presented on social media. Results show that individuals are more likely to bet on certain types of bets (medium complexity) when presented on an affiliate account. This raises concerns about risks of affiliate marketing.	Uses an experimental design and randomises the presentation of advertisements to reduce bias. Looks at social media and affiliate marketing that is under-researched.	The study may lack external validity. The authors impute missing data, but do not discuss testing the missing data to see if there is any potential bias.
2	Noble *et al.* [49]	2022	Observational	Aggregate	This article exploits a large cross-sectional survey on adolescent behaviour to estimate the impact of gambling advertising on gambling behaviour in this subgroup. Results indicate that those who are more exposed to sports advertising have higher involvement in gambling in the past 30 days, and are more likely to be an at-risk or 'problem' gambler. However, these results are no longer significant after controlling for a number of confounding variables.	This study uses a large, weighted sample of rich data on youth gambling behaviour with well-validated measures.	The measure of gambling advertising may fail to capture that sports advertisements can also occur on-line, and therefore, may still have an effect.
3	Roderique-Davies *et al.* [43]	2020	Experimental	Embedded	This article uses a randomised pilot experiment to test the impact of embedded gambling advertising on gambling urge and to compare whether this differs between sports (higher risk) and non-sports (lower risk) students. Participants reported increased urge to gamble when presented with embedded advertising, and this was significantly higher for sports students who had higher PGSI scores. Sports students were also urged to gamble when presented with a sports non-advertising condition, indicating that there may be an innate association between football and gambling for this subgroup.	This study uses novel experimental methods in this area of research to try and elicit urge to gamble following exposure to embedded advertising.	This is only a pilot study so the sample is small. The experiment may lack external validity because the clips were shorter than a full football game, and were not live.
4	Russell *et al.* [52]	2019	Observational	Aggregate	This study uses a cross-sectional survey of Australian adults to explore who bets on micro-events, and which variables are associated with micro-betting. Results indicate that higher exposure to gambling advertising is associated with reduced betting on micro-events.	The study uses a large sample and controls for a number of important demographic and gambling-related confounders.	Micro-betting is technically not legal in Australia, therefore, it is unlikely that the advertising these people are exposed to is advertising micro-bets.

TABLE 1 (Continued)

No.	Authors	Year	Study type (MMAT)	Advertising type	Summary	Strengths	Limitations
5	Hing *et al.* [34]	2019	Observational	Traditional, on-line, direct, embedded	This study uses EMA methods to measure exposure to, and perceived influence of, wagering advertisements and inducements. Results indicate that all types of advertisements and inducements were more likely to prompt a higher frequency of bets and larger bets among race bettors reporting any influence. For sports bettors, this was true for the frequency of bets. Sports bettors reported placing safer bets in response to advertisements, which might be because of the content of the advertisement decreasing the perceived risk of the bet.	The use of EMA helps to minimise recall bias in advertising exposure while enhancing the ecological validity of findings.	The study uses a non-representative sample and is mostly descriptive.
6	Hing *et al.* [53]	2018	Observational	Aggregate	Using a cross-sectional on-line survey the authors examine the effect of wagering advertisements on 'impulse' betting on sport. Results indicate that certain inducements, such as bonus bets, increased 'impulse' betting during the game. However, exposure to advertising had a negative association with 'impulse' betting during the game. Reporting higher watching of sports was associated with greater 'impulse' betting.	This study uses a large sample of data and multiple regression analysis controlling for a number of potential confounding variables.	The authors also rely on the participant's subjective judgement of an 'impulse' bet.
7	Russell *et al.* [47]	2018	Observational	Direct, inducements	This study uses EMA to survey race and sports bettors over 1 week of key sporting events in Australia. Participants were asked to forward direct emails and text messages received to the authors' over the same period. Regression models showed that direct messaging was significantly associated with higher intended and actual expenditure on betting. Text messaging was seen as the most important method for actual expenditure, potentially because of its quicker response rate compared to emails.	EMA may reduce recall bias while enhancing the ecological validity of findings. The study asks participants to directly forward emails and texts. It uses regression models that control for individual variability in betting.	The percentage of direct messages forwarded to the researchers was variable and quite low for sports bettors.
8	Hing *et al.* [45]	2017	Observational	Sponsorship, aggregate	This study explored the impact of gambling promotions on sports betting behaviour in a sample of internet sports bettors in Australia. Regression models suggest that exposure to promotions is not significantly associated with 'problem' gambling scores, but a higher	This study uses regression models with controls for important confounders (age, gender, attitudes and approval of promotions).	The authors use a proxy measure of advertising exposure.

(Continues)

TABLE 1 (Continued)

No.	Authors	Year	Study type (MMAT)	Advertising type	Summary	Strengths	Limitations
					perceived impact of promotions on behaviour is positively and significantly associated with PGSI scores.		
9	Hing *et al.* [51]	2016	Observational	Aggregate	This study uses descriptive methods to analyse the impact of demographic, behavioural and normative risk factors for gambling problems. It uses self-reported watching of sports as a proxy measure for exposure to advertising and finds that increased exposure is associated with a significant increase in total PGSI score.	The study uses a large sample and examines a variety of risk factors for gambling problems.	The authors' do not use regression analysis and, therefore, do not control for potential confounding factors.
10	Di Censo *et al.* [39]	2023	Experimental	Digital, inducements	This study looks at the impact of betting inducements on the perceived betting behaviour of young people in the UK, Australia and New Zealand. Results show that higher-risk gamblers are more likely to be influenced by inducements, and sign-up offers are the most influential. When controlling for other confounding factors, regressions indicate that those at a higher risk of harm are more likely to believe that inducements exacerbate their gambling.	This study uses professionally generated advertisements to enhance the external validity of findings and minimise branding effects. It randomly exposed participants to advertisements to reduce order effects. It also undertakes quantitative research in a subgroup where there has been mostly qualitative work.	The study may lack contextual factors because the advertisements were not related to a real-world live sporting event. They only measure perceived impact on betting, which may differ from actual betting.
11	Hing *et al.* [42]	2015a	Observational	Embedded	This study estimates the impact of exposure to gambling promotions on gambling intentions. Results indicate that higher exposure is associated with increased intentions to bet in the next 6 months, after controlling for additional gambling characteristics. Summary data suggests that individuals with a higher PGSI group report a higher impact of advertising on their frequency, expenditure and time spent betting.	This study uses a panel to recruit participants, which results in a more representative sample with lower risk of missing data.	This study relies on a proxy measure of advertising. The study measures intentions and not actual betting.
12	Hing *et al.* [42]	2015b	Observational	Embedded	This study looks at the average perceived impact of gambling advertising on sports betting behaviour among different PGSI groups. Results indicate that 'problem' gamblers report that advertising impacts their frequency, expenditure and time spent betting, whereas other PGSI groups do not. The difference between groups is statistically significant.	This study uses a panel to recruit participants, which results in a more representative sample with low risk of missing data.	This study reports descriptive statistics only.

TABLE 1 (Continued)

No.	Authors	Year	Study type (MMAT)	Advertising type	Summary	Strengths	Limitations
13	Lopez-Gonzalez and Griffiths [50]	2021	Observational	Aggregate	This study explores the differing impact of gambling advertising on gambling behaviour between different PGSI groups in a sample of Spanish sports bettors. Results indicate that higher-risk gamblers report a significantly greater perceived impact of advertising on behaviour compared to lower-risk gamblers.	This study uses a panel to recruit participants, which reduces biases from missing data or non-response. It also applies this research question to the Spanish context, which is the only article in this review to do so.	The study measures perceived impact on betting, and not actual impact.
14	Johnston and Bourgeois [44]	2015	Observational	Sponsorship	This study uses hierarchical regression models to explore the existence of a 'third-person effect' in gambling sponsorship advertising. Within their models, the authors' identify that increased exposure to sponsorship advertising is associated with an increased intention to use that sponsor. Additionally, those who perceive sponsorship advertising as having a 'powerful' effect on themselves have significantly higher intentions to use the sponsor.	This study uses a potentially more representative quota sample. The authors' also control for a number of potential confounding factors in their models.	The purpose of this study was not to measure the impact of advertising on behaviour.
15	Hing *et al.* [46]	2014	Observational	Sponsorship, aggregate	This study measures the impact of exposure to advertising during sports on the sports betting intentions of young people age 12 to 17 in Australia. Correlation analyses show a significant positive association between exposure to advertising and intention to bet once 18. However, this is no longer significant when included in a regression model with additional controls.	This study is one of few to look at this research question among under 18 year olds. The authors' use an on-line panel to collect the sample to attempt to make it more representative of the population of interest.	The results might reflect that this is a more general sample rather than a sample who are highly involved in sports watching. The study relies on a proxy measure of exposure.
16	Wardle *et al.* [40]	2022	Observational	Direct, digital	This study explores the impact of gambling marketing on unplanned gambling spend in a large sample of British sports bettors. Results indicate that those at a higher risk of gambling harm are significantly more likely to report that gambling marketing prompts unplanned gambling spend compared to those at no risk of harm. The effect sizes are large, particularly for 'problem' gamblers. Additionally, exposure to direct marketing and to a gambling brand on social media increase the likelihood of reporting that marketing prompts unplanned spend.	This study uses a large and weighted, therefore, representative sample of British sports bettors. The authors' control for a number of important confounding variables in their regression models.	The study cannot measure the value of unplanned spend.

(Continues)

TABLE 1 (Continued)

No.	Authors	Year	Study type (MMAT)	Advertising type	Summary	Strengths	Limitations
17	Browne *et al.* [69]	2019	Observational	Direct, TV, inducements, aggregate	This article uses EMA methods to estimate the impact of exposure to advertisements and inducements on intended, actual and excess gambling spend among race and sports bettors. The results indicate that aggregate exposure to advertisements and inducements is significantly associated with likelihood of betting and actual spend on betting. For race bettors only, this association applies to excess spend too. Specific inducements that have an impact are stake-back offers, direct messaging and TV advertising.	This study uses EMA methods, which help to enhance the ecological validity of data and minimise response biases. The authors are also able to collect actual betting spend data.	There was significant attrition in the surveys.
18	Rockloff *et al.* [48]	2019	Experimental	Inducements	This study uses an on-line experiment to explore the impact of inducement type on selection of odds (short, medium, long). Results indicate that participants were significantly more likely to select longer odds when presented with inducements versus no inducements. Only cash rebate showed an independent significant effect. No differences were found by PGSI group.	This study uses an experiment that has strong internal validity because the researchers can control for exposure to inducements and can minimise contextual confounding factors.	This study may lack external validity because it lacks these contextual factors that may impact betting behaviour (e.g. betting on a live game).
19	Sproston *et al.* [41]	2015	Observational	Traditional, digital	This report explores the impact of sports and race betting marketing on gambling behaviours in a large sample of adults and adolescents. Logistic regression models indicate a strong positive correlation between exposure to digital sports betting marketing and sports betting in the last 12 months. Betting on racing in the last 12 months was significantly associated with exposure to traditional (TV and radio) race betting marketing. Higher frequency of betting on EGMs and other gambling types was associated with increased exposure to traditional race marketing, and also digital race marketing for the latter. In the adolescent sample, only exposure to digital race marketing was associated with likelihood of betting on other activities.	This report uses a large sample of adults and adolescents (who are rarely researched in this area).	The adolescent sample size is small.

TABLE 1 (Continued)

No.	Authors	Year	Study type (MMAT)	Advertising type	Summary	Strengths	Limitations
20	Schottler Consulting [35]	2012	Observational	Aggregate	This report explored the impact of sports gambling marketing on unplanned betting and unplanned gambling spend in a sample of Australian adults. Descriptive results showed that on average, participants did not feel that sports betting marketing prompted them to spend money or bet when they had not intended to. However, risk of 'problem' gambling was a significant predictor of influence of marketing on unplanned behaviour in a stepwise regression, although the correlations were low.	This report uses a weighted sample for the population of bettors in New Zealand.	The results of this study are descriptive. It may have been difficult for respondents to categorise planned vs. unplanned behaviour that may lead to some reporting biases.
21	Russell and Hing	2020	Observational	Aggregate	This report investigates advertising before and during the initial COVID-19 lockdown period in Australia. Descriptive results indicate that, on average, respondents felt that advertising did not impact their gambling expenditure in either period. However, participants were significantly more likely to report a reduction in expenditure because of advertising during lockdown compared to before, which was a period where exposure to advertising was lower. This may indicate a small protective effect of reduced advertising.	This report uses a large sample of respondents to explore an interesting period where sports betting advertising reduced because of the halting of live sports.	Results are descriptive. A large percentage of the sample had not bet at all, had not bet on sports and held no accounts with operators in the 12 months before lockdown.
22	Jenkinson *et al.* [37]	2023	Observational	Traditional, embedded, digital, aggregate	This report explored the impact of sports and race betting advertising on gambling behaviours in Australia. Results indicated a strong correlation between exposure to advertising and betting on sports or racing. Additionally, 20%–30% of participants reported that any type of advertising influenced the amount they bet, whether they bet on impulse, whether they tried a new product and whether they started betting at all. These results were more pronounced in younger and at-risk individuals.	This report uses a large sample, which is representative in terms of age, gender and location of residence.	The results are descriptive.

Abbreviations: COVID-19, coronavirus disease 2019; EGMs, electronic gaming machines; EMA, Ecological Momentary Assessment; MMAT, Mixed Methods Appraisal Tool; PGSI, Problem Gambling Severity Index; TV, television; UK, United Kingdom.

TABLE 2 Summary of study characteristics and results.

Study characteristics								
No.	**Funding**	**Setting**	**Population**	***N***	**Sampling method**	**Definition of bettors**	**Methods**	**Statistical methods**
1	Gamble Aware	UK	18+	100	Opportunity	Regular football bettors (at least once a month)	Experimental	Two-way factorial ANOVA and independent sample *t* tests
2	Victorian Responsible Gambling Foundation	Australia	12–17	4993–6377	Random (weighted)	N/A	Cross-sectional survey	Logistic mixed regression models (with controls)
3	No mention of funding	UK	18 + (students)	60	Opportunity	Gambled at least once in the last 12 months (including National Lottery)	Randomised Experimental	Two-way factorial ANOVA and independent sample *t* tests
4	Centre for Gambling Education and Research (Southern Cross University)	Australia	18+	1813	Convenience	Bet on sports in the last 12 months	Cross-sectional survey	Two-step zero inflated regression (with controls)
5	Victorian Responsible Gambling Foundation	Australia	18+	722	Convenience	Bet on horse/greyhound racing or sports betting at least fortnightly	Ecological Momentary Assessment (longitudinal)	Descriptive statistics (%)
6	Victorian Responsible Gambling Foundation	Australia	18+	1813	Convenience	Bet on sports in the last 12 months	Cross-sectional survey	One-way ANOVA and multiple linear regression (with controls)
7	Queensland Department of Justice and Attorney General (Responsible Gambling Research Grant)	Australia	18+	455	Purposive	More than 0% betting via the internet	Cross-sectional survey	Zero-inflated regression models (with controls)
8	Victorian Responsible Gambling Foundation	Australia	18+	202	Convenience	At least fortnightly race or sports bettors	Ecological Momentary Assessment (longitudinal)	Negative binomial regression (with controls)
9	Queensland Department of Justice and Attorney General (Responsible Gambling Research Grant)	Australia	18+	639	Purposive	Bet on sports in the last 12 months	Cross-sectional survey	Spearman's correlation and Kruskal-Wallis tests
10	NSW Office of Responsible Gambling (NSW Responsible Gambling Fund)	UK/Australia/New Zealand	18–24	130	Purposive	Prior experience with sports betting	Cross-sectional survey	Two (risk-level) by four (inducement type) mixed ANOVAs and hierarchical regression models (with controls)
11	Queensland Department of Justice and Attorney General (Responsible Gambling Research Grant)	Australia	18+	1000	Purposive	N/A	Cross-sectional survey	Summary statistics and hierarchical regression (with controls)
12	Queensland Department of Justice and Attorney General	Australia	18+	544	Purposive	At least fortnightly sports bettors	Cross-sectional survey	Summary statistics (mean values) and ANOVA

TABLE 2 (Continued)

Study characteristics								
No.	**Funding**	**Setting**	**Population**	***N***	**Sampling method**	**Definition of bettors**	**Methods**	**Statistical methods**
	(Responsible Gambling Research Grant)							
13	Grant from the Government of the Basque Country, Spain and Spanish Organisation of the Blind	Spain	18+	659	Purposive	Bet on sports in the last 12 months	Cross-sectional survey	Kruskal-Wallis and χ^2 tests
14	University of Queensland Postdoctoral Research Fellowship	Australia	18+	511	Quota	N/A	Cross-sectional survey	Hierarchical regression (with controls)
15	Queensland Department of Justice and Attorney General (Responsible Gambling Research Grant)	Australia	12–17	131	Purposive	N/A	Cross-sectional survey	Hierarchical regression (with controls)
16	The Economic and Social Research Council/The Wellcome Trust	UK	18+	3195	Purposive (weighted)	Bet at least monthly on sports	Cross-sectional survey	Logistic regression (with controls)
17	Victorian Responsible Gambling Foundation	Australia	18+	597	Purposive	At least fortnightly sports bettors	Ecological Momentary Assessment (longitudinal)	Linear mixed effects regression models (with controls)
18	Victorian Responsible Gambling Foundation	Australia	18+	299	Purposive	Bet on AFL, cricket, or soccer at least twice in the previous 12 months	Experimental	Wilcoxon signed rank test, ANOVA, χ^2 test
19	Gambling Research Australia	Australia	13+	3200	Purposive	Gambling at least once a month	Cross-sectional survey	Logistic regression (with controls)
20	New Zealand Ministry of Health	New Zealand	18+	157	Quota (weighted)	Gambled at least once in the last 12 months (including Lotto)	Cross-sectional survey	Summary statistics (mean Likert) and stepwise regression (with controls)
21	Victorian Responsible Gambling Foundation	Australia	18+	2120	Purposive	Gambled at least once in the 12 months before initial lockdown, or in the 2 months of lockdown	Cross-sectional survey	Summary statistics (% Likert, McNewmar-Bowker test)
22	Australian Gambling Research Centre	Australia	18+	1765	Community (aligned with population parameters)	N/A	Cross-sectional survey	Summary statistics (% Likert)

Abbreviations: AFL, Australian Football League; ANOVA, analysis of variance; NSW, New South Wales; UK, United Kingdom; N/A, Not Applicable.

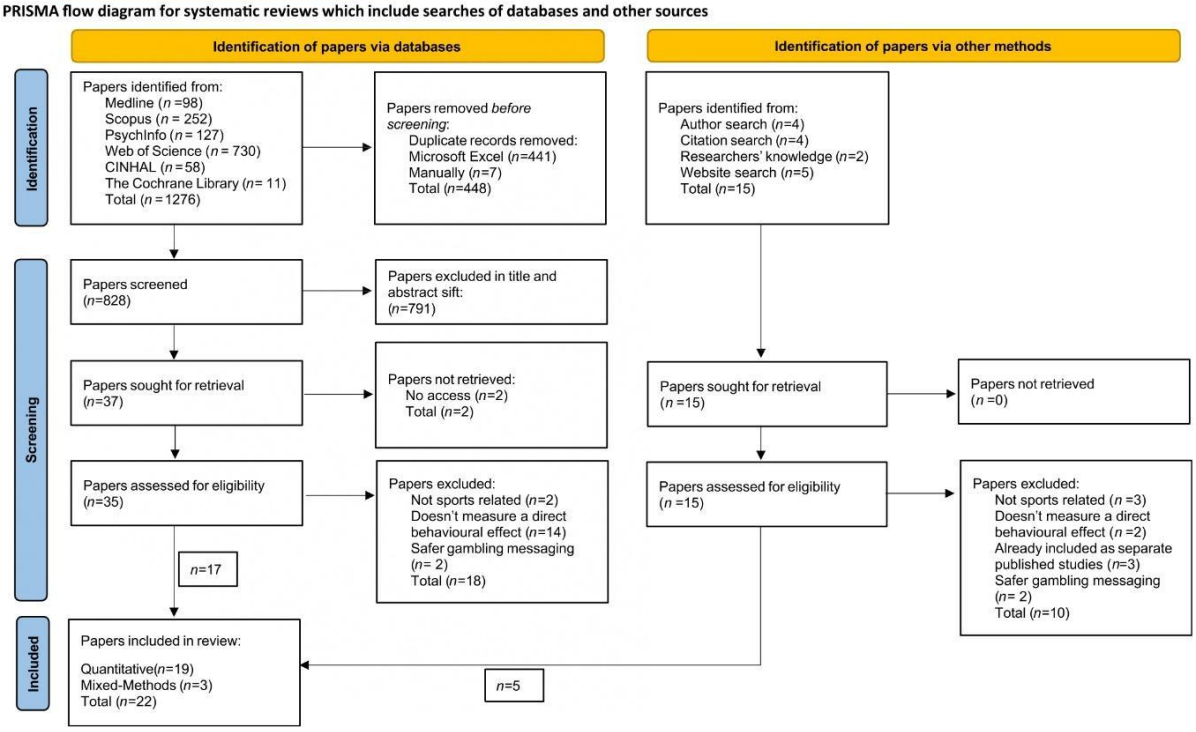

FIGURE 1 Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) flow diagram for systematic reviews.

accessible [32, 33]. Four articles were identified from citation searches of included studies. Searches of authors who appeared more than once in the author list of included studies identified an additional five articles. Further search strategies included web-sites of relevant gambling and government organisations (five articles identified) and the lead reviewer's knowledge (two articles identified). See Appendix B for a list of authors and web-sites searched. After the full-text search, a total of 22 studies were included in the final review.

Description of included studies

Characteristics

The broad methodologies of included studies were experimental (*n* = 4), and observational (*n* = 18) (Table 1). The majority of studies used cross-sectional surveys (*n* = 15), with a small number of longitudinal studies (*n* = 3). A substantial number used measures of perceived impact of advertising on gambling behaviour (*n* = 10). For a description of the measures used in each specific study, see Appendix C.

Studies took place in Australia (*n* = 16), the United Kingdom (UK) (*n* = 3), Spain (*n* = 1), New Zealand (*n* = 1) and a combination of these countries (*n* = 1). Sampling methods included purposive (*n* = 12), convenience (*n* = 4), quota/stratified (*n* = 3), opportunity (*n* = 2) and random weighted sampling (*n* = 1). Samples comprised adults (*n* = 19), adolescents (*n* = 2) and mixture of both (*n* = 1). The majority of studies were funded by independent government organisations (*n* = 18). Other funding sources included independent trusts/charities (*n* = 1), postdoctoral research fellowships (*n* = 1) and non-independent gambling charities (*n* = 1). One study did not report any funding source. A more detailed data extraction table is available in Appendix D.

RESULTS

Traditional (e.g. TV, radio, print)

Several studies explored the impact of traditional marketing on gambling behaviour. One study [34] reported that 29% to 43% of sports bettors and 30% to 38% of race bettors reported ever feeling influenced by television, radio or print advertisements. This was higher than on-line advertising, but lower than embedded and direct forms. A grey literature report found that a higher frequency of race betting, and frequency of using electronic gaming machines (EGMs), was significantly associated with higher exposure to traditional race betting marketing [35]. There is some evidence that TV advertisements influence actual expenditure on gambling for race bettors in Australia [36]. An Australian study also reported that television advertising was the most influential advertising media for initiating betting (1 of 7 people) and changing what people bet on (1 of 10 people) [37].

Digital (e.g. web-sites, social media)

Approximately 30% to 50% of sports bettors, and 27% to 47% of race bettors report ever being influenced by on-line advertising on web-sites or social media in an Australian study [34]. Two studies used fake social media advertisements, constructed by the researchers, to measure bet complexity [38] and gambling risk level using the Problem Gambling Severity Index (PGSI) [39]. Researchers exposed individuals to advertisements and measured responses. Participants increased the complexity of bets when an advertisement was present on an affiliate (partner) social media account compared to an operator. This was despite being significantly more likely to place lower complexity bets and spend less on higher complexity bets, overall [38]. Additionally, higher-risk gamblers (measured using a 10-item subscale of high-risk gambling developed using diagnostic and symptomatic criteria) were more likely to believe that inducements on social media exacerbate their gambling harms [39]. Being exposed to marketing on social media on at least one platform significantly increased the likelihood of unplanned gambling spend in a sample of sports bettors [40]. A report [41] indicated that higher exposure to sports betting marketing through digital media was associated with gambling on sports in the last 12 months. Additionally, a higher frequency of gambling on other types of activities was significantly associated with increased exposure to digital race betting marketing. In the adolescent sample, only digital race betting marketing was significantly associated with higher intention to gamble on other activities.

Embedded (e.g. sponsorship, pitch-side)

Various studies explored embedded advertising within sports broadcasts. One study suggested that approximately 40% of sports and race bettors report ever being influenced by embedded advertising [34]. Another [42] suggested that higher-risk gamblers report a significantly higher impact of embedded gambling advertising during televised sport on their perceived frequency, expenditure and time spent betting on sports, although overall scores were low. One study indicated that direct advertising had the highest impact on increased betting (17% reported this impact) and placing 'impulse' bets (13% reported this impact) [37]. One study used randomised methods to estimate the impact of embedded advertising on gambling urge [43]. When exposed to a professional football game with embedded gambling advertising, students reported higher urges to gamble, and urges were significantly higher for sports compared to non-sports students. Sports students were perceived to be higher-risk because of their comparatively higher mean PGSI scores. Another study [42] revealed that exposure to this type of advertising was associated with an increased intention to bet in the next 6 months. An Ecological Momentary Assessment (EMA) study in Australia suggested that brand promotion influenced actual bet spend among sports bettors [36]. EMA involves surveying participants' behaviour in a natural environment. In this context, it involved measuring self-reported exposure to advertising and gambling behaviour as close as possible to their actual occurrence. One study [44] found that increased exposure to sponsorship advertising was significantly associated with intentions to use a sponsor. Additionally, adults who perceived sponsorship advertising to have a 'powerful' effect on themselves exhibited a higher intention to use that sponsor. Another article [45] reported that individuals with a higher PGSI score, and therefore, at a higher risk of harm, were more likely to report that they would use gambling products in response to gambling sponsorship. However, in an adolescent sample, there was a general disagreement that sponsorship would lead to the use of a sponsor's product [46].

Direct (e.g. emails or texts)

One study indicated that 57% of sports bettors and 24% of race bettors reported ever being influenced by direct messaging [34]. Individuals experiencing harm from gambling are significantly more likely to report that direct marketing had prompted unplanned gambling spend compared to those not experiencing harm. Being exposed to at least one or more types of direct marketing also significantly increased the likelihood of unplanned gambling spend in the same study [40]. Another study reported that the total number of direct messages received was associated with an increased likelihood of betting for race and sports bettors and an increased amount bet for race bettors [47]. Direct advertising through text messages increased actual betting in the whole sample. The number of direct emails was associated with an increased intention to bet, and intention to bet with larger amounts, for the whole sample, and the likelihood of actually placing a bet for sports bettors only. Direct messaging is reported to influence intended, actual and excess spend among Australian race bettors [36].

Inducements (e.g. free bets or stake-back offers)

One study used simulated videos of sports games to measure the effect of inducements on riskiness of betting [48]. Participants chose longer, riskier, odds when inducements were present during a sports game compared to when they were not. Cash inducements were particularly influential, exhibiting a greater risk profile [48]. In another study [39], social media advertisements with a sign-up inducement were best at explaining higher risk gambling scores in men age 18 to 45 compared to all other inducement types. An EMA study in Australia indicated that stake-back offers influenced actual bet spend for race bettors [36]. In models without additional controls, the number of direct messages containing stake refund offers and bonus odds were associated with actually placing a bet, and sign-up and match-stake inducements increased the amount bet among race bettors [47]. For sports bettors, these results were less clear with bonus wins and direct messages with no inducements increasing the likelihood of placing a bet in models without controls. Stake-back, multi-bet and match-your-stake inducements were particularly influential in one study [34].

Aggregate (total frequency of exposure across all types)

In an Australian EMA study, aggregate exposure to advertising and inducements increased actual expenditure on gambling [36]. Aggregate exposure to advertising also increased excess spend among race bettors. Two studies surveyed adolescents and found that overall exposure to sports gambling advertising was associated with increased intentions to gamble when they reached the legal age [46], likelihood of gambling in the last 30 days, gambling on 'hard' activities (e.g. casino games) and being a higher-risk gambler [as measured using the Diagnostic Statistical Manual IV adapted for juveniles (DSM-IV-[MR]-J)] [49]. However, these relationships were not statistically significant when other control variables were included in the model.

Higher-risk gamblers reported that advertising influences their frequency, expenditure and time spent betting to a greater degree than lower-risk gamblers in one study [42]. Higher-risk gamblers report a greater impact of advertising on frequency of betting on sports compared to lower-risk gamblers in another [50]. Watching more live sports, and therefore, being more frequently exposed to gambling advertising, is reportedly associated with a higher PGSI score [51]. Other studies support these findings, but results were not statistically significant [45].

Studies looking at 'micro' or 'impulse' betting found evidence contradicting the other studies in this review [52, 53]. Betting on micro-events (a form of in-play betting) is controversial because it reduces the time between betting and the outcome and, therefore, may be more harmful. These are similar to 'impulse' bets defined by Hing and colleagues [53] as spontaneous or unplanned bets. These studies found that exposure to advertising were associated with a reduced likelihood of placing these types of bets.

A report in New Zealand found, on average, a very low mean likelihood of placing a bet or unplanned spending on gambling in response to advertising [35]. However, descriptive results from an Australian report found that younger people and higher-risk individuals were more likely to report that gambling advertising influenced the amount they bet, whether they bet on impulse, whether they tried a new product or whether they started betting for the first time [37]. There was also a strong association between exposure to advertising and betting on sports or racing in the previous 12 months. Finally, a report [54] described weak-to-moderate positive correlations between frequency of exposure to advertising of sports and race betting and frequency of gambling on each form. Correlations for sports betting decreased during lockdown, and respondents were more likely to report that expenditure had decreased because of advertisements during this time. This may have been a period of reduced advertising because of the sports shutdown in Australia, therefore, it may suggest a small protective effect of this reduced advertising on gambling behaviour, which is further supported by respondents reporting less frequent exposure to sports advertising during lockdown [54].

Quality of methodologies

Overall, studies reported their aim(s) or research question(s) clearly within the article and they collected data that was suitable for answering their research question. However, most measures of advertising exposure were proxied measures. The main limitation of this evidence is that most studies fall under the observational category, and therefore, are less able to establish causal relationships. Data tends to be self-reported cross-sectional and may be subject to bias. Samples tend to be non-representative. However, this is appropriate for the context because studies over-recruit higher-risk gamblers to ensure that there are sufficient numbers in each gambling risk category. Additionally, research questions often mean that purposive or convenience samples of regular gamblers are necessary. The use of panels to recruit samples might introduce some bias given these people have signed up to take surveys, so they may differ somewhat from the general population [55]. A limitation of this evidence base is the lack of standardised measures of advertising or gambling behaviour. However, there is no agreed measure of a unit of gambling behaviour, and measuring advertising exposure is difficult outside of controlled experiments.

Despite this, the use of experimental methods in recent years enhances the internal validity of findings because researchers can control for actual exposure to advertising. Other promising studies use EMA, which reduce recall biases and enhances the external validity of findings [56] by measuring exposure to advertising and gambling behaviour as close to their occurrence as possible and in a real-world setting. Despite their drawbacks, using on-line panels to recruit samples can enhance the completeness and quality of data collected. More recent studies use large, weighted population samples of bettors, which improves representativeness of samples. Several studies use regression models with controls for potential confounding factors (such as age, sex and previous gambling behaviour). For a more detailed examination of the methodological quality of each study, see Appendix E.

DISCUSSION

The review aimed to provide the most systematic and up-to-date review of the quantitative literature on sports-related gambling advertising, as defined in this study, and its relationship with gambling behaviour. We narratively synthesised and critically analysed the evidence to identify knowledge gaps using refined search criteria to answer a research question of relevance to public health policy. The evidence suggests that there is a positive association between sports-related gambling advertising and gambling behaviour. Descriptive results indicate that this may be more pronounced in higher-risk gamblers who are already at increased risk of harm. These results hold across different advertising media.

Young adults at higher risk of gambling harm may be more affected by embedded advertising during sports, and within this group, watching football may go hand-in-hand with sports betting.

Furthermore, sponsorship advertising might increase the likelihood of using a sponsor's products among adults. There is preliminary evidence for an association between sports-related advertising and gambling behaviour in samples under the age of 18, although results were not always statistically significant. This could be partly because of small sample sizes. Social media advertising via affiliate accounts may contribute to gambling harm by increasing the complexity of bets placed because of their differential framing of bets as lower risk. Inducements that reduce the risk or cost of gambling, such as sign-up or stake-back offers, might have a greater impact. Direct messaging, especially texts because of their quicker response time might be an important influence on gambling behaviour. The self-reported impact of advertising on behaviour appears to be more pronounced among higher-risk gamblers, as measured using the PGSI. The contradicting effects found in studies on in-play betting might occur because this type of betting is not technically legal (micro-betting) or as easily accessible (in-play) in the country studied (Australia). These results corroborate and supplement the results found in previous reviews [15–17].

Future research should prioritise experimental and longitudinal studies to strengthen the evidence base. Randomised experimental studies, in which people are randomised to advertising exposure, are required to demonstrate causal inference. There are some examples of these in this review. Quasi-experimental studies, where external variation in advertising exposure is used to infer causality, would be useful for enhancing the ecological validity of findings. Collecting actual betting data from individual accounts could reduce the risk of reporting bias. Studies on adolescents should focus on obtaining larger samples. There will likely be improvements in this area of research as we collect more data on gambling behaviour. This year, one of the largest survey on gambling behaviour in the world commenced in Great Britain [57]. Such datasets broaden opportunities for future research.

Strengths and limitations

This review provides the most up-to-date and systematic review of the literature on the relationship between sports-related gambling advertising and gambling behaviour. This is relevant to current gambling policy in the United Kingom and world-wide. It also refines the search criteria of previous reviews to look at quantitative evidence. This makes the results of this review more relevant for health economic modelling, which can be used to measure the impact of policies on behaviour and subsequent health.

A single quantitative effect size for sports-related advertising, which could be used in health economic modelling, could not be defined at this stage because a meta-analysis was not appropriate. This review excluded studies not published in English and most of the studies were conducted in Australia. This restricts our ability to make cross-country comparisons. The same issue applies to the age range of studies, which mostly cover adult populations. Future research should look at including other countries and age groups. The accuracy of grey literature searching and its potential contributions to systematic reviews is contested. There is a risk that evidence may be missed or be of lower quality because of a lack of peer review. Nonetheless, it was appropriate in this case for reasons provided. There is one study where we cannot definitively say that sports-related advertising was measured [40], but we make the assumption that it was most likely to be this type of advertising given that it is a sports betting sample.

Implications for public health policy

The implication of these findings is that current policies that allow for sports-related gambling advertising may be contributing to gambling harm by increasing betting. Further research is needed to corroborate this and strengthen the case for causal effects and to provide quantitative evidence that can be used in health economic modelling of gambling harms. The acceptance of self-regulation of gambling advertising in the United Kindgom is justified by the claim that there is no direct causal evidence for advertising's impact on population health [24, 58], because studies only indicate a direct link to participation in gambling and not to health outcomes. However, we can indirectly assume that the increased gambling behaviour reported in these studies is exacerbating harms given the evidence for the relationship between harms and increased expenditure and frequency of betting [59–63], despite disagreement over the shape of this relationship [64]. Low-risk gambling guidelines in Canada also encourage reduced spending and frequency of gambling to minimise harm [65]. To strengthen the evidence base, future studies on advertising might include measures of health-related quality of life to estimate the direct impact of exposure to advertising on population health. Despite the limitations of measures [66], there is some evidence for the impact of gambling on population health-related quality of life [67–69]. This requires further research. In the meantime, government intervention may be justified based on the evidence for links between advertising and gambling and gambling activity levels and gambling-related harm. This is especially important given that this effect may be more pronounced in higher-risk gamblers who are already more vulnerable to harm. The World Health Organisation recommends comprehensive advertising policies for alcohol and tobacco [70, 71]. It may be time for governments to adopt these recommendations for gambling.

A review gambling legislation in the United Kingdom [24] has not detailed any major changes to gambling advertising. It requests consultations on cross-selling of products; this could be beneficial given the evidence on direct marketing in this review. There is no statement on restricting inducements, which have been identified as potentially influential in this review, except for encouraging a socially responsible approach. Sport sponsorship has been left to the discretion of sports governing bodies. The Premier League has agreed to a front-of-shirt gambling sponsorship ban for the 2026 to 2027 season, but this does not include sponsorship visible on the arms of football shirts or on pitch-side hoardings. The evidence in this review highlights some potentially influential types of advertising such as text messaging and pricing promotions. Without specific guidance on how these types of advertisements may be used in a way that minimises their negative effects, we may see increased gambling harms.

[1] Please note that in paragraph 2 the term 'ecological' should be replaced with 'external'.

There are global implications of this research beyond the United Kingdom. In Australia, calls to restrict gambling advertising during live sports are growing since a 2023 parliamentary report recommended a phased total ban on on-line gambling advertising and sponsorship in the next 3 years [72]. Some European countries have implemented variations of partial to full advertising bans, some self-regulatory [69–71, 73–75]. The success of some of these policies is contested [76, 77]. The findings reported here support the need for intervention using comprehensive approaches, which include all types of advertising media, to protect those most vulnerable to harm.

CONCLUSION

This systematic review explored the relationship between sports-related gambling advertising, as defined in this study, and gambling behaviour. It concluded that there is a positive association between different types of sports-related gambling advertising and gambling behavioural outcomes. This finding may be more pronounced in higher-risk gamblers, who are at increased risk of harm. Future research should expand on experimental and longitudinal evidence and consider including gambling health-related quality of life outcome measures, to strengthen the evidence base. In the meantime, governments might intervene based on the precautionary principle and the indirect evidence of gambling harm.

AUTHOR CONTRIBUTIONS

Ellen McGrane: Conceptualization (lead); data curation (lead); formal analysis (lead); funding acquisition (lead); investigation (lead); methodology (lead); project administration (lead); writing—original draft (lead). **Robert Pryce:** Methodology (supporting); project administration (supporting); supervision (supporting); writing—original draft (supporting). **Matt Field:** Methodology (supporting); project administration (supporting); supervision (supporting); writing—original draft (supporting). **Shangshang Gu:** Formal analysis (supporting); methodology (supporting); writing—original draft (supporting). **Esther C. Moore:** Formal analysis (supporting); methodology (supporting); writing—original draft (supporting). **Elizabeth Goyder:** Conceptualization (supporting); formal analysis (supporting); investigation (supporting); methodology (supporting); project administration (supporting); supervision (lead); writing—original draft (supporting).

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CLINICAL TRAIL REGISTRATION

Prospero Registration: CRD42024509195

DECLARATION OF INTERESTS

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DATA AVAILABILITY STATEMENT

There is no data available to share since this was a systematic literature review.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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Chapter Four: The impact of TV advertising on gambling behaviour: a mixed-methods feasibility study

4.1 Chapter Overview

Chapter Three recognised a lack of longitudinal and experimental research exploring the impact of sports-related gambling advertising on gambling behaviour. This type of evidence is needed to strengthen the case for causal effects. Chapters Four to Six will address this by designing, testing, and implementing a quasi-experimental study measuring the impact of television advertising on gambling behaviour. This chapter details the first stage: a feasibility study that tests the methods of recruitment and data collection prior to the full study being conducted.

4.2 Research Question and Aims

This chapter describes a feasibility study for a larger quasi-experimental study measuring the impact of television advertising on gambling behaviour. It specifically tests whether it is feasible to recruit a sample and collect longitudinal betting data during a global sporting event. It assesses a number of details to inform the final design of the quasi-experimental study in Chapter Five including:

1. Recruitment and data collection
2. Survey questions
3. Respondents' experiences with the study

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4.3 Methods

4.3.1 Rationale

A feasibility study is a smaller version of a full study that can be used to identify potential problems with the study, provide an opportunity to refine the study design, and test the practicality of implementing the study (OHID, 2020). It ask whether something can be done, and how it should be done (Eldridge *et al.*, 2016; The National Institute for Health and Care Research (NIHR), 2021). There are several reasons why a feasibility study was appropriate for this thesis:

The context

The final quasi-experimental study (Chapter Five) relied on live football games being televised across two broadcasters: one with television gambling advertising, and one without. The 2022 men's football World Cup was the best opportunity to undertake this study throughout the duration of this PhD. The next event using this broadcasting setup would not occur until July 2024 (the men's Euros football tournament), three months prior to the original thesis deadline. Therefore, it was imperative that the methods of recruitment and data collection were tested and refined prior to the World Cup to ensure that the final study would be successful, and the opportunity was not missed. Given my minimal experience in primary data collection, and the use of online recruitment panels, this was crucial in reducing the risk of problems when administering the final study.

The lack of standardised measures of gambling behaviour

Given the lack of standardised measures of gambling behaviour, as highlighted in Chapter Three, testing the validity of survey questions was important. In particular, this chapter assesses the feasibility of collecting individual screenshots of betting account transaction statements to compare to self-reported survey data on gambling behaviour. The accuracy of self-reported gambling behavioural data has been contested (Hodgins and Makarchuk, 2003; Wood and Williams, 2007; Braverman, Tom and Shaffer, 2014; Auer and Griffiths, 2017; Heirene, Wang and Gainsbury, 2022; Auer *et al.*, 2024). However, taking data directly from gambling companies is associated with a conflict of interest

since they might be involved in the research, sometimes through funding. It is important to note that most of the above-referenced literature is authored by gambling researchers who receive industry funding and use industry data. Self-reported data is more often used in public health gambling research. Nonetheless, this still remains an important issue. Some studies have used banking data (Muggleton *et al.*, 2021), but these do not detail wins and losses which may be important for gambling behaviour and harms (Markham, Young and Doran, 2016). Others have used data on debt, credit scores, and bankruptcy (Davies, Evans and Collard, 2023; Hollenbeck, Larsen and Proserpio, 2024) associated with gambling. No study has attempted to collect individual screenshotted betting account transaction data for this purpose before.

4.3.2 Design

This study employed longitudinal surveys between 2nd March 2022 and 13th April 2022 during the European World Cup qualifying playoff matches. From here, these will be referred to as 'playoff matches'. Playoff matches occurred on 24th and 29th March 2022. Due to the conflict in Ukraine, matches involving Russia and Ukraine did not take place, and as such, the study was limited to the remaining matches. Data were collected from a sample of men in the UK aged between 18 and 45 who regularly watch and gamble on football. There were four compulsory surveys comprising a baseline survey, two match-related surveys, and a follow-up survey. There was an additional optional survey and focus group.

4.3.3 Sample

Minimum sample sizes of between 12 and 50 are recommended in the literature for feasibility studies (Julious, 2005; Hertzog, 2008; Sim and Lewis, 2012). To obtain 50 responses, expecting a response rate of 50%, I had a target sample of 100 people. Due to the purposive nature of the sample, and potentially restrictive screening questions, 150 potential participants were invited to complete the screening survey; this prevented the need to extend screening to more people if the target sample of eligible participants was not reached. Sampling was undertaken in groups in an attempt to minimise costs and maximise response rates. Once the minimum of 100 eligible participants were identified, the 50 participants with the highest gambling frequency were invited to

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complete the baseline survey and confirm their participation in the study by completing a consent form. If some participants did not respond at this stage, then invites were extended to the remaining 50 eligible participants in increments of 5 until the final sample size of 50 was reached. Recruitment is described in more detail below.

4.3.4 Participants

The inclusion and exclusion criteria for participants is detailed in Table 1. Participants with a self-reported history of treatment for personal gambling problems were excluded for ethical purposes, to minimise risk of harm. For logistical purposes, respondents were required to have access to Sky Sports to take part in this study; the games of interest were shown on this channel only. This is not a requirement for the final study in Chapter Five which uses games on free-to-air television.

Table 1: Inclusion and exclusion criteria for the feasibility study

Inclusion Criteria	**Exclusion Criteria**
Sex: males Age: 18 to 45 Gambling: regular football gamblers (at least once in the last 12 months) Geographical location: UK Other: Planning to watch some of the playoff matches	Gambling: A history of, or currently being treated for, personal gambling problems Other: No access to Sky (subscription channel)

Due to budget constraints, a purposive sample based on sex, age, geographical location, and gambling behaviour was used for all studies using primary data collection in this thesis (Chapters Four to Six). Males were selected due to their high rates of participation in gambling and higher risk of gambling-related harm based on their scores on the PGSI (DfC, 2017; PHE, 2023; The Gambling Commission, 2023, 2024). The Gambling Survey for Great Britain (2023) indicates that men are almost twice as likely to have a PGSI score of 8 or more ('problem gambling') compared to women, making them an important subgroup for gambling-related policy research. Younger people also report higher PGSI scores, especially those ages 18 to 24, but generally those below the age of 45, and

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therefore the sample was focused on this age group. Existing literature has highlighted them as an important vulnerable group (Dowling *et al.*, 2017; Russell *et al.*, 2019; Latvala, Lintonen and Konu, 2019; McGee, 2020; Moreira, Azeredo and Dias, 2023).

A purposive sample of higher frequency gamblers was also selected to ensure the representation of gamblers in each risk category. While this may appear to align with the person-centred approach (Rose, 1985), it instead permitted the representation of the full range of gambling from no risk to the highest risk, ensuring that those in the higher-risk groups are well-represented in the data, a method used in other studies (Hing *et al.*, 2015). Importantly, the selection of higher risk demographic groups does not imply that all participants were high-risk gamblers Many participants in this study were experiencing no or low risk of harm. The above reasoning guides the sample selection used in the remainder of this thesis, particularly Chapter Five.

4.3.5 Recruitment

Participants were recruited using Prolific (https://prolific.ac/), an online platform that links researchers with potential participants. Prolific distributed a screening survey to males, aged 18 to 45, from the UK, who stated that they regularly watch football (n=2653). The screening survey was designed to capture a more targeted sample of individuals based on the above criteria (Table 1). Each participant at this stage received £0.75 to compensate for the time taken completing the screening survey regardless of their eligibility: a requirement of the survey platform. In total, 105 participants were eligible. Of these, 5 were excluded due to accidental duplication. These duplicates were reviewed to ensure that the participants did not change their responses when repeating the screening survey and no discrepancies were identified. The final number of eligible participants was 100.

The 50 participants with the highest reported gambling frequency were invited to take part in the study. This purposive sampling approach is commonly employed in gambling advertising research to ensure representation across all gambling risk groups, as represented by the PGSI (Hing *et al.*, 2015). Given that approximately half of the adult population in Great Britain does not gamble at all (Public Health England (PHE), 2023; The National Centre for Gambling Research (NatCen), The University of Glasgow and The Gambling Commission (UK), 2023), purposive sampling can be particularly valuable in

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focusing on those most likely to be affected by gambling-related advertising, namely, regular gamblers.

Participants were ranked by gambling frequency, from highest to lowest, using responses to a question adapted from the 2018 Health Survey for England (NHS England, 2018):

"Thinking now about gambling on football. How often have you gambled on a football game during the last 12 months?
Every day
Five to six days a week
Three to four days a week
Once a week
Once or twice a month
Once every couple of months
Once or twice a year
Not at all in the last 12 months"

Response options ranged from "every day" to "once or twice in a year," and only individuals who reported gambling more than "not at all in the last 12 months" were considered eligible. The top 50 individuals on this list were then invited to participate. There was no specific cut-off for inclusion, participants were invited in order from the highest to lowest frequency category. In cases where gambling frequency category was equal, the order of response (from earliest to latest) was used as a secondary sorting criterion. While this method prioritised those with higher gambling frequency and, by extension, higher gambling risk, the final sample included individuals across the PGSI spectrum, from 'non-problem' gamblers to those classified as 'problem gamblers' (Table 4). The sampling methods were designed to ensure that individuals in higher-risk gambling categories were better represented than they would be in a general population sample. This approach also underpins the sampling strategy employed in Chapter Five.

Total reimbursement for this study ranged between £20 and £35 depending on the number of surveys completed (Table 2).

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Table 2: Reimbursement schedule for the feasibility study

Survey	Reimbursement	Cumulative Total
Baseline	£5	£5
24th March	£5	£10
29th March	£5	£15
Follow-up	£5	£20
Screenshots of betting statements	£5	£25
Focus group	£10	£35

4.3.6 Surveys

Respondents were sent a baseline questionnaire on 2nd March 2022 comprising a number of demographic, behavioural, and health-related questions. These questions were adapted from the 2018 Health Survey for England (NHS England, 2018). Participants completed two surveys on 24th and 29th March 2022 which measured their gambling on the aforementioned match dates. Surveys were released following the final game of the day (approximately 9pm). Participants were asked whether they watched a playoff match, and whether they had gambled, on that particular day. They were asked about their intentions to gamble in the future. Most questions required a 'yes/no' response (e.g. did you watch a playoff match today?) or had an open box to allow the respondent to input their answer freely (e.g. how many bets did you place?). Frequency of bets was selected as the most appropriate measure of gambling behaviour since it most likely reflects the causal mechanism through which advertising prompts behaviour, namely, the placement of an additional bet. This is explained in more detail in Chapter Five where this variable is used in formal statistical analysis (Section 5.2.10 Dependent Variables). This chapter does not explicitly measure exposure to gambling advertising given that the purpose of this chapter was to test the methods rather than explore the relationship between gambling advertising and gambling behaviour. Details of all survey questions are included in Appendix 2 Table 1.

A follow-up questionnaire was released on 31st March 2022 asking participants whether they made an overall win or loss on the bets they placed, and whether they had chased their losses over the period studied. Loss chasing refers to an intensification of betting when facing persistent losses (Lesieur, 1979; Zhang and Clark, 2020; Banerjee *et al.*,

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2023). It is a key clinical symptom of gambling dependence (5th ed.; DSM-5; APA, 2013). Finally, participants were given an open box to provide general feedback.

4.3.6.1 Transaction Statements

Following the compulsory section of the study, participants were invited to take part in additional surveys. Firstly, they were asked if they would be willing to upload screenshots of their betting account transaction statements across the period studied. Participants who answered 'yes' were invited to upload screenshots in a separate survey for an additional £5 reimbursement, alongside a set of instructions on how to do this (see Appendix 2 Figure 1 for these instructions). The transaction statements of interest were simple balance sheets which vary by gambling operator.

4.3.7 Focus Group

A smaller group (n=10) of respondents were invited to take part in a focus group on 13th April 2022. The purpose of this was to collect in-depth responses from participants about their experience with the surveys. Participants were sent a new information sheet and consent form to sign. The focus group took place on Google Meetings where the audio was recorded to be transcribed verbatim. It lasted approximately 45 minutes and involved an open and interactive discussion with little structure. There were three pre-determined topics of interest to the research to guide the discussion; the surveys, reimbursement, and transaction statements.

The choice to use focus groups instead of individual interviews was driven primarily by time constraints. However, this method also encouraged interactive discussions among participants, enriching the data by fostering the exchange of ideas and perspectives that might not emerge in one-on-one interviews (Clark *et al.*, 2021). Focus groups also offer insight into how widely held certain views are within a group (Clark *et al.*, 2021), making them particularly valuable in the exploratory stages of research. While this format may have affected some individuals' willingness to participate, particularly those uncomfortable in group settings, measures were taken to create a more inclusive environment. Participants were informed that their cameras would remain off throughout the session and were given the option to use the chat function instead of speaking via microphone, if they preferred.

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4.3.8 Measures

The key outcome measures for this study were:

1. Recruitment and data collection: testing the recruitment and data collection methods to identify potential issues and to understand the general interest in this study including recruitment and retention rates.
2. Gambling data: ensuring that the questions were measuring what they intended to: specifically, the timing and frequency of bets.
3. Respondents' experiences: qualitatively understanding respondents' experiences with the study, particularly regarding their experiences completing the surveys, reporting (or not reporting) transaction data, and their views on the reimbursement schedule. This was to inform the final design of the survey and any potential reasons for missing data.

4.3.9 Data Analysis

Data were cleaned and summarised using STATA 17. Due to the nature of the study, and its limited sample size, descriptive statistics have been reported. The focus group data was analysed using a deductive (a priori) thematic approach (Clarke and Braun, 2017). Thematic analysis is a method used to identify, analyse and report themes within qualitative data (Braun and Clarke, 2006; Clarke and Braun, 2017). This form of thematic analysis was judged to be the most appropriate given that this is an exploratory study with pre-determined topics of interest. Of particular importance for the focus group was understanding respondents' experiences with completing the surveys, reporting (or not reporting) transaction statements, and their perceptions of the reimbursement schedule. These three broad topics were determined before the focus group, used to guide the focus group, and to thematically analyse the qualitative responses from participants. Qualitative data analysis was undertaken using NVivo 10 where responses were coded into each topic. Results are reported in terms of each topic (theme).

4.3.10 Ethical Approval

This project was approved by the University of Sheffield's Ethics Review Procedure, as administered by the Sheffield Centre for Health and Related Research (SCHARR): application number 044687.

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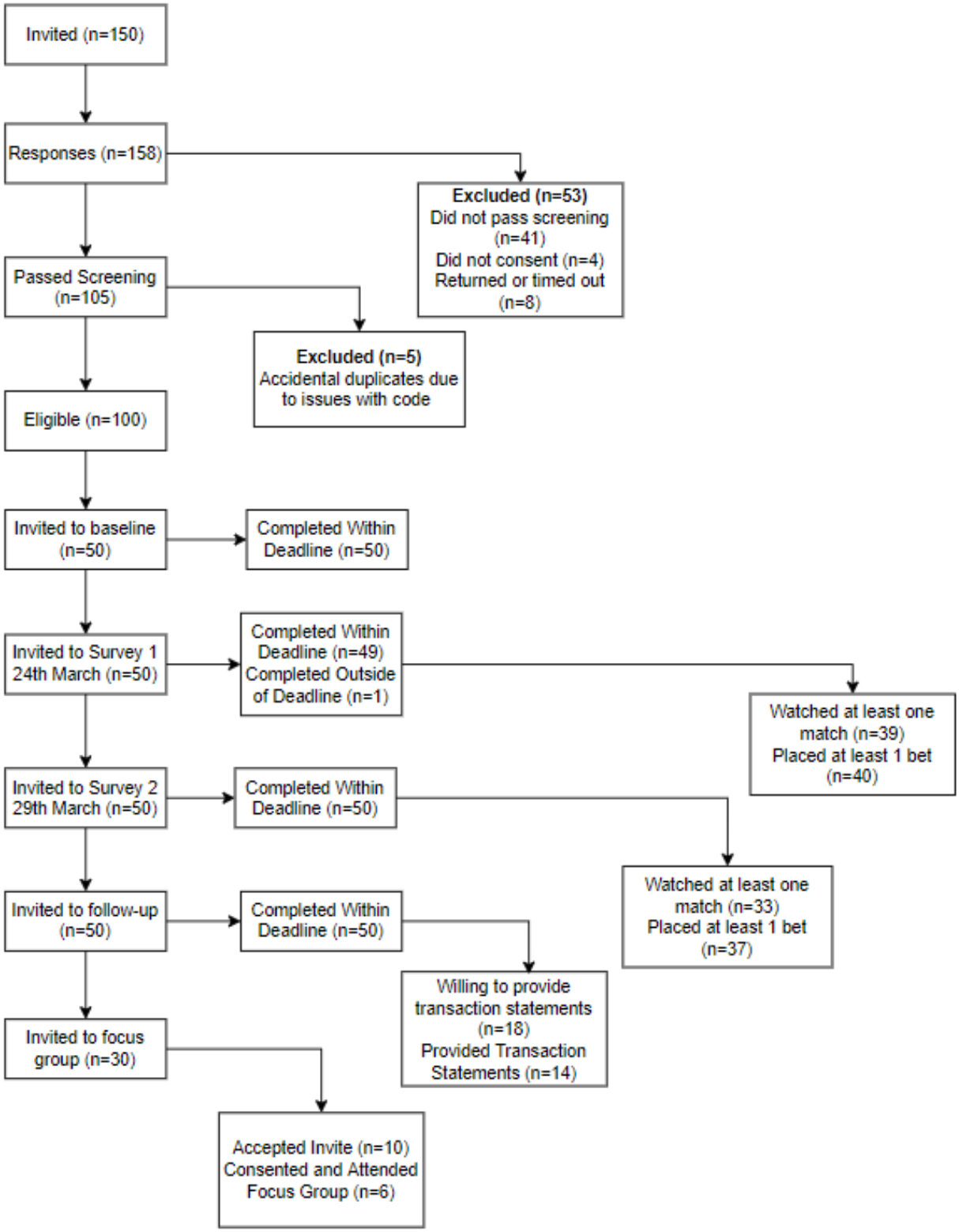

Figure 5: Recruitment and retention flow chart for the feasibility study

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4.4 Results

4.4.1 Recruitment

Firstly, 150 respondents were invited to screening (Figure 5). There were 158 responses recorded in Qualtrics; the discrepancy is due to submissions being returned incomplete or timed out. All 50 participants who were invited to baseline consented to participation and completed all three surveys. Due to low response rates a total of 30 respondents were invited to the focus group, 10 accepted the invite, and 6 provided consent and participated in the final focus group.

4.4.2 Sociodemographic Characteristics of the Sample

Table 3 shows that the majority of the sample were of white British or Irish background, employed, and earning between £20,000 and £39,999. Participants tended to report good or very good general health. A majority (70%) of the sample reported some existing feelings of depression, with 20% stating that they were feeling more depressed than usual. The average age of the sample was 34, and the sample covered all regions of the UK, with the largest percentage residing in London (20%). Average life satisfaction (0 to 10) was below average (6.5); average life satisfaction in the UK is 7.45 (Office for National Statistics (ONS), 2023). This was likely due to the selectivity of the sample which consisted of higher-frequency male gamblers in a specific age range.

4.4.3 Gambling and Other Behavioural Characteristics

The sample were actively involved in betting on sports (Table 4), placing an average of 16 weekly bets, and spending a weekly average of £99. Over half of the sample were categorised as either moderate-risk or high-risk gamblers (as measured using the Problem Gambling Severity Index (PGSI)), which is much larger than reported in Great Britain and Northern Ireland (DfC, 2017; The Gambling Commission, 2023). This is likely due to the purposive sampling methods. These methods are common in the gambling literature as they allow researchers to collect sufficient numbers of gamblers in each risk-group, therefore higher-risk gamblers (those who score in the higher-risk categories on the PGSI) tend to be over-sampled (Hing *et al.*, 2015). The mean PGSI score in the sample was 4.6 (moderate-risk). Participants bet at least weekly, and half of the sample reported almost always betting alone. The top three preferred operators were Betfair, Sky Bet, and Bet365. The most common type of gambling activity was online betting on sport

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or an event. Other popular activities included the national lottery, online games and betting on horse racing. This is different to the general population who prefer the lottery and scratchcards over sports betting (DfC, 2017; The Gambling Commission, 2024c). The majority of the sample were at low-risk of alcohol dependence as measured using the Alcohol Use Disorders Identification Test – C (AUDIT-C). However, 42% were at an increasing or higher-risk level.

Table 3: Sociodemographic characteristics of the feasibility study sample

Variable		***Mean (SD)***	***Range***
Age			
		34 (7)	(18, 45)
Life Satisfaction			
		6.5 (2)	(1, 10)
		Frequency	***Percentage***
Ethnicity			
	White British or Irish	40	80%
	Mixed/ Multiple Ethnic Backgrounds	3	6%
	Asian/Asian British	3	6%
	Black/African/Caribbean/ Black British	3	6%
	Other	1	2%
Area of Residence			
	London	10	20%
	South East	7	14%
	North West	6	12%
	East England	6	12%
	East Midlands	5	10%
	West Midlands	4	8%
	North East	3	6%
	Scotland	3	6%
	Yorkshire & Humber	2	4%
	Northern Ireland	2	4%
	South West	1	2%
	Wales	1	2%
Employment			
	Employed	47	94%
	Unemployed	3	6%
Annual Income			
	£0-£19,999	8	16%
	£20,000-£39,999	27	54%
	£40,000-£59,999	9	18%
	£60,000-£79,999	3	6%

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	>£79,999	3	6%
General Health			
	Very Good	12	24%
	Good	25	50%
	Fair	13	26%
	Bad	0	0%
	Very Bad	0	0%
Feeling Depressed			
	Not at all	15	30%
	No more than usual	25	50%
	Rather more than usual	9	18%
	Much more than usual	1	2%
Probability Question			
	Correct	24	48%
	Incorrect	19	38%
	Don't Know	7	14%

**The probability question was included for two purposes: first, as an attention check to ensure respondent engagement; and second, to explore whether individuals who engage in regular betting demonstrate an understanding of probability. Participants were presented with the following open-ended question: "Imagine you have a standard coin with heads on one side and tails on the other. What is the probability that you flip the coin twice in a row and get heads both times?"*

Table 4: Gambling and other behavioural characteristics of the feasibility study sample

Variable		***Mean (SD)***	***Range***
Weekly Bets			
		16 (14)	(2, 50)
Weekly Spending on Bets			
		£99 (£129)	(£1, £500)
Number of Accounts			
		9 (8)	(1, 30)
		Frequency	*Percentage*
PGSI			
	Non-problem gambler	6	12%
	Low-risk gambler	15	30%
	Moderate-risk gambler	21	42%
	Problem gambler	8	16%
Betting Frequency			
	Every day	3	6%
	5 to 6 days a week	16	32%
	3 to 4 days a week	25	50%
	Once a week	6	12%
Betting Alone			

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	Almost always	25	50%
	Most of the time	22	44%
	Sometimes	3	6%
	Never	0	0%
Chosen Operator			
	Betfair	13	26%
	Sky Bet	13	26%
	Bet365	9	18%
	Paddy Power	7	14%
	Ladbrokes	4	8%
	Coral	2	4%
	Betfred	1	2%
	Livescore Bet	1	2%
	William Hill	0	0%
Betting Types			
	Online betting on sport/event	46	92%
	National Lottery	38	76%
	Online Games	35	70%
	Horse Races	34	68%
	Scratch Cards	32	64%
	Sports events (bookmakers)	31	62%
	Betting Exchange	25	50%
	Fruit/Slot Machines	18	36%
	Bingo	17	34%
	Football Pools	15	30%
	Virtual Gaming (bookmakers)	13	26%
	Dog Races	13	26%
	Table Games (Casino)	8	16%
	Poker in a tournament	7	14%
	Other events (bookmakers/phone)	3	6%
AUDIT-C			
	Low-risk	29	58%
	Increasing risk	16	32%
	Higher risk	5	10%
	Possible dependence	0	0%

Correlations between variables were low and did not reach statistical significance (Table 5). This is likely due to the low sample size in this study which results in higher standard deviations, and a lower Pearson's correlation and t-statistic. Nonetheless, there are low-to-moderate significant positive correlations between weekly bets, weekly bet spend, and the number of accounts, which is to be expected. The signs of the remaining

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correlations are as presumed. Higher life satisfaction is associated with a lower AUDIT-C, PGSI score, number of accounts, weekly bet spend and weekly bet frequency. A higher PGSI score is associated with a higher number of accounts, weekly bet spend and weekly bet frequency.

Table 5: Pearson's correlations between variables in the feasibility study

	1	***2***	***3***	***4***	***5***	***6***	***7***
1. Age	1.00						
2. Weekly Bets	0.15	1.00					
3. Weekly Spend	0.03	**0.47**	1.00				
4. Number of Accounts	-0.02	**0.47**	**0.67**	1.00			
5. PGSI Score	-0.23	0.12	0.28	0.22	1.00		
6. Audit C Score	-0.05	0.10	0.04	0.05	0.22	1.00	
7. Life Satisfaction	0.07	-0.12	-0.19	-0.13	-0.27	-0.11	1.00

Note: figures in bold are statistically significant at the 1% level.

4.4.4 Survey One: 24th March

Survey data is presented in Table 6. On 24th March, 78% of participants watched at least one playoff match. A total of 80% placed a bet, most commonly 1 bet. The three most popular ways to follow the match, other than viewing it on television, were online via social media platforms, text feed, and in betting apps. The majority of respondents disagreed that they had bet more than they had intended to on these matches. However, 20% felt that they had, to some degree. Over 90% of respondents intended to bet on the playoff match on the following match day. Just under half of the sample placed other sports bets on this day, and just over a third placed other bets including online casino games. The majority of bets were placed on the same day as the game. For the first recorded bet, 25% were placed within the hour of the match kick-off, or during the game itself. The pattern was similar for the 2nd and 3rd recorded bets. The numbers become too small to determine a meaningful interpretation for recorded bets greater than 3.

4.4.5 Survey Two: 29th March

On 29th March, 66% reported watching at least one game, and 74% placed a bet. The results of this survey were similar to the previous survey. For example, the most popular frequency of bet remained at 1, and the most common ways to follow the match were similar (Table 6).

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4.4.6 Follow-up

Over two thirds of the sample reported that they made a win on the bets placed on the matches over the two days observed. A minority (6%) reported that they had chased their losses at some point. Only 38% of the sample were completely loyal to their preferred operator reported in the baseline survey (Table 7).

Table 6: Survey data (feasibility study)

Variable	**Description**	**24th March**	**29th March**	**Follow-up**
Match Viewing				
	Watched a Match	39 (78%)	33 (66%)	-
	Placed a Bet	40 (80%)	37 (74%)	-
	Both	32 (82%)	29 (88%)	-
Follow Match				
	None	4 (8%)	3 (6%)	
	Radio	3 (6%)	3 (6%)	-
	Online (social media)	19 (38%)	27 (54%)	-
	Text Feed e.g. BBC	14 (28%)	15 (30%)	-
	Betting Apps	28 (56%)	24 (48%)	-
	Other	2 (4%)	5 (10%)	-
Number of Bets				
	0	9 (18%)	13 (26%)	-
	1	19 (39%)	23 (46%)	-
	2	8 (16%)	9 (18%)	-
	3	9 (19%)	3 (6%)	-
	4	1 (2%)	1 (2%)	-
	5	2 (4%)	1 (2%)	-
	6	1 (2%)	0 (0%)	-
Bet More than Intended				
	Strongly Agree	1 (2%)	2 (5.5%)	-
	Somewhat Agree	7 (18%)	7 (19%)	-
	Neither Agree nor Disagree	4 (10%)	2 (5.5%)	-
	Somewhat Disagree	14 (35%)	7 (19%)	-
	Strongly Disagree	14 (35%)	19 (51%)	-
Intention to Bet				
	Strongly Agree	29 (58%)	-	-
	Somewhat Agree	18 (36%)	-	-
	Neither Agree nor Disagree	2 (4%)	-	-
	Somewhat Disagree	3 (6%)	-	-
	Strongly Disagree	0 (0%)	-	-
Other Sports Bets				

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	Yes	23 (46%)	24 (48%)	-
	No	27 (54%)	26 (52%)	-
Other Bets (e.g. online casino games)				
	Yes	18 (36%)	19 (38%)	-
	No	32 (64%)	31 (62%)	-
Win or Loss				
	Win	-	-	34 (68%)
	Loss	-	-	14 (28%)
	Not Applicable	-	-	2 (4%)
Loss Chasing				
	Yes	-	-	3 (6%)
	No	-	-	40 (80%)
	Not Applicable	-	-	7 (14%)
Transaction Statements				
	Yes	-	-	18 (36%)
	No	-	-	32 (64%)

Table 7: Participants' loyalty to their preferred operator (feasibility study)

	Frequency	**Percentage**
Yes	19	38%
No	17	34%
Partially	9	18%
N/A	5	10%
Total	50	100%

**'Yes' means they only bet with their preferred operator; 'No' means they did not bet with their preferred operator; 'Partially' means they bet with their preferred operator and other operators during the tournament.*

4.4.7 Transaction Statements

Just over a third of the sample responded that they would be willing to upload screenshots of their transaction statements from their online betting accounts. In total, 14 participants (28%) successfully uploaded these statements, and the frequency of individual screenshots ranged from 1 to 17. The quality of the data varied considerably. Screenshots from certain operators were extremely detailed. Other screenshots were barely informative. Only 7 participants (14%) reported transaction data that could be used to validate their self-reported data. The remaining participants reported

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screenshots that did not contain any information on their playoff match bets, and others reported basic deposit statements with little information. I have included two examples of the data, the remaining transcribed screenshots can be found in Appendix 2 Figures 2 to 13.

4.4.7.1 Transaction Data Example 1

Participant 42 self-reported that they watched the Wales Vs Austria game on 24th March and placed 3 bets: Wales Vs Austria, Portugal Vs Turkey, and Sweden Vs Czech Republic all more than an hour before the match. Their screenshotted data validated this and reported the exact times of the bets; 17:50, 17:53 and 18:31 respectively (Figure 6). These were all more than an hour before the start of the games (19:45). It also showed that the participant placed £5 on each match for the outcome of a draw, and that they lost all bets except the Sweden Vs Czech Republic bet, which earned them £16.50 in winnings. Contrastingly, their data for the 29th March indicated that they double-reported their bet on Poland Vs Sweden, and omitted their Wales Vs Czech Republic bet (Figure 6).

Date	Match	Sport	Bet type	Detail	Stake	Time	Win/Loss	Winnings
24/03/2022	Wales Vs Austria	Football	Single	Match outcome (to draw)	£5	17:50	Loss	-£5
24/03/2022	Portugal Vs Turkey	Football	Single	Match outcome (to draw)	£5	17:53	Loss	-£5
24/03/2022	Sweden Vs Czech Republic	Football	Single	Match outcome (to draw)	£5	18:31	Win	£16.50
29/03/2022	Poland Vs Sweden	Football	Single	Match outcome (to draw)	£5	18:52	Loss	-£5
29/03/2022	Netherlands Vs Germany	Football	Single	Both to score	£5	18:53	Loss	-£5
29/03/2022	Wales Vs Czech Republic	Football	Single	Match outcome (to draw)	£5	18:55	Win	£15.63
29/03/2022	Rochdale Vs Carlisle United	Football	Single	Match outcome (Rochdale to win)	£5	18:58	Win	£11

Figure 6: Participant 42's screenshotted betting transaction data (transcribed)

4.4.7.2 Transaction Data Example 2

Participant 11 accurately recalled their single bets for games on 29th March, but excluded a bet on Portugal Vs North Macedonia which was part of an accumulator with 11 other bets (Figure 7).

Date	Match	Sport	Bet type	Detail	Stake	Time	Win/Loss	Winnings
29/03/2022	Poland Vs Sweden	Football	Single	Total book	£30	18:15	Loss	-£30
29/03/2022	Poland Vs Sweden	Football	Single	Under/ove	£12.77	12:12	Loss	-£12.77
29/03/2022	Portugal Vs North Macedonia	Football	Accumulator (11)	Under/ove	-	12:12	Win	£29.99

Figure 7: Participant 11's screenshotted betting transaction data (transcribed)

4.4.8 Focus Group

Six participants took part in a focus group at the end of the study. The results of the focus group discussion have been grouped by pre-determined topic (theme).

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4.4.8.1 Participants' Experiences with Completing the Surveys

This discussion sought to determine the burden of the surveys on participants, including the ease of filling out the surveys. Participants generally thought that the process was straightforward:

"It was straightforward for me too, it wasn't overcomplicated or anything" – Participant 34

"It was talking about something I was doing anyway and it was kind of at the forefront of my mind and so it wasn't too much of a chore to think of a hypothetical example like you get in some surveys." – Participant 29

Participants highlighted that the surveys were not time-consuming:

"I probably spent much longer placing my bets and deciding what to bet than doing the surveys. It was quite easy to find the time to fit it in." – Participant 29

Most participants used their laptops to complete the surveys. Participants 29 and 46 reported used a chrome extension on Prolific which notified them when the survey went live. Respondents agreed that that the surveys kept them engaged. Some felt that they could really contribute to the study. Others felt that it offered some security. In general, they did not feel fatigued over the course of the study despite there being multiple surveys:

"I like the surveys that like carry on over the month like that did…because there's more interaction and you knew kind of what was coming." – Participant 43

"I actually felt we could contribute to it quite well over a sustained period of time, and I felt that the reasons behind the survey was quite positive as well and I actually enjoyed it." – Participant 46

One suggestion that respondents made was to include a question on bet type. As mentioned in the previous section, some participants struggled to report bets as part of multiple or accumulator bets. The betting question was often interpreted as only asking for single bets:

"Some of the bets I was placing were on multiple games and the questions were worded as if they were sort of umm…aimed at single games…I didn't know if I would say 'yeah I have been betting on the Portugal game", or if it were a completely different category'." – Participant 33

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"You didn't give the option for ACCAs [Accumulators] or anything like that, like I think umm... a lot of people are gonna put accumulators on" – Participant 34

One participant mentioned the difficulty of having multiple accounts, and that specifying in more detail which bets they should report would be useful:

"Someone said earlier that they have a number of different accounts and that's the same for myself ...in terms of the actual placing bets, it's really broad as well so giving us something specific that you want to sort of hone in on ... that would also be good to know." – Participant 46

4.4.8.2 Participants' Views on the Reimbursement Schedule

This part of the discussion aimed to understand whether the reimbursement was appropriate for the time requirements of the study. Respondents felt that the study was well paid:

"I actually enjoyed it and the payment was decent as well." – Participant 46

"I think with the amount of money per effort I suppose ummm...sort of stood out as being quite high, so I was prioritising these ones." – Participant 33

One participant suggested that an alternative system might be better, which many other participants agreed with:

"It was very well paid! However, I think you'd be better off offering a smaller reward for the initial surveys...you could then offer a 'bigger' bonus as a reward at the end." – Participant 27

However, participants' felt that there needed to be a good balance to ensure people would still be engaged.

4.4.8.3 Participants' Experiences with Reporting (or Not Reporting) Transaction Statements

The final part of the discussion explored the willingness to report transaction statements, and the ease of doing so. The consensus was that asking for transaction statements was not invasive. Respondents felt secure due to the anonymity of the study and did not feel like they were sharing anything too personal:

"Personally I am not divulging any personal information, nothing sensitive or anything, it's literally just a list of transactions so that could belong to anyone. So I didn't really bother me to be honest, like sending it. It takes like 30 seconds to do a screenshot and send it over so there wasn't a massive amount of effort." – Participant 34

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"If people are willing to talk about gambling online and willing to take the survey I don't think it's too much of a stretch. But I guess still don't enforce it but it's a nice extra incentive." – Participant 29

They highlighted the ease of taking a screenshot, but also discussed how this varied between operators with different websites:

"Yeah it's pretty easy it just depends on the bookie, and that's not a reflection on the survey that's just how good or bad their websites." – Participant 29

However, one respondent reported difficulty due to holding multiple accounts with different operators:

"I've got more than one account and so I know when we uploaded the screen grabs I think, yeah…then that was a bit tricky because I was having to try and like dig through different bookies." – Participant 29

"There was one bookie, I think because of an offer as someone mentioned earlier…one that I don't normally use and their website wasn't very good and it was a bit harder to find the bet…. it was just like an extra one or two minutes rather than hours" – Participant 29

However, one participant noted questioning whether they should upload their data:

"I sort of had a split second where I thought 'should I really divulge how much I have been betting on some of these really obscure games that I didn't really care about?" – Participant 29

A suggestion was to ask for screenshots at the beginning of the surveys and to tell participants to screenshot bets as they win (or lose) them:

"I was going to say if you mention it at the start… 'each time you place a bet take a screen shot or grab and then…there will be an opportunity at the end for extra money if you upload them'…I feel like I might have found that a bit easier." – Participant 33

Overall, there was an agreement that this data would help to improve the quality and validity of the data overall:

"In some ways…some of the people it would put off would be the people who don't fill out surveys being truthful and honest. It's almost like uploading a bit of evidence isn't it?" – Participant 33

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"You'd get more quality rather than quantity perhaps… I think if I had the receipts it feels like you'd got a more authentic representation of people doing online gambling." – Participant 29

4.5 Discussion

This chapter described a feasibility study which tested the methods for a quasi-experimental study detailed in Chapter Five of this thesis. It assessed a number of items to inform the final design of the study:

1. Recruitment and data collection
2. Survey questions
3. Respondents' experiences with the study

4.5.1 Recruitment and Data Collection

The process of recruitment using Prolific was quick and easy from a researcher's point of view. There were no issues with study retention; all participants who were eligible and invited completed all of the surveys. This is consistent with the broader literature on recruitment, retention and engagement using Prolific (Peer *et al.*, 2022; Albert and Smilek, 2023). It might also be because the task was not hypothetical, and was therefore easier to engage with, as alluded to in the focus group. Data from the surveys provides information on the frequency and timing of bets, which is important for the future study. However, some adjustments to the survey questions may be required.

4.5.2 Survey Questions

The wording of questions in this feasibility study may have led to under-reporting of multiple or accumulator bets. Participants suggested providing a more specific explanation of the type of bet being collected. For example, whether it was a single, an accumulator, or a free bet.

Despite focus group participants reporting that providing transaction statements was non-invasive and easy, the value of this data is questionable. This data is highly complex due to participants holding several accounts with different operators. The varying quality of operator websites also contributed to this. Therefore, there may be some barriers to reporting this data. The data may be biased if people with a higher number of accounts were less likely to report their screenshotted data. Lower response rates may also have been due its non-compulsory aspect. As indicated in the focus group discussion,

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participants felt that it should remain non-compulsory, but they should be made aware of this prior to the study commencing. However, there is a risk that participants may behave differently if they know they are being observed (Landsberger, 1958). Whilst a number of people who did not report transaction statements were invited to the focus group, none accepted. Therefore, I was not able to obtain their reasons for opting out. It would be interesting to explore the collection of this data in the future, but it is unlikely to be of value to the study in Chapter Five. This is due to its high cost versus the quantity and quality of data it produces. In future, individuals could request their betting data directly from their providers. However, this is likely to be time consuming, and betting companies may not agree to sharing data. It may also damage an independent researcher's reputation, especially if they are not able to set their own research questions for the data provided.

4.5.3 Respondents' Experiences with the Study

Data from the focus group indicates that participants enjoyed the study and felt like they were contributing to something important. They found the survey easy and quick to complete, and accessible. They felt that it was well-paid compared to other studies and suggested changing the structure of the reimbursement schedule to better reflect the time committed to the study. They felt that reporting their transaction statements was generally easy, but that this varied by operator and depended on the number of accounts they held with different operators.

4.5.4 Strengths and Limitations

This study tested the feasibility of collecting longitudinal betting data during a global sporting event to inform a future quasi-experimental study. Additionally, it tested methods of collecting screenshots of betting account data directly from individuals to test the reliability of self-reported betting data. This is the first study to do this, however, low response rates and poor-quality data suggest that alternative methods may be more useful in future research.

This is a feasibility study, so data analysis was descriptive. The surveys were sent late in the evening following the matches. It might have been more practical to send these the day after the matches, but it helped to minimise recall time. The use of an online panel to recruit participants introduces a risk of bias (Pickering and Blaszczynski, 2021); those

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who self-select into joining an online panel might differ from the general population of bettors. However, research suggests that Prolific may produce higher quality data compared to other crowdsourcing platforms (e.g. MTurk) based on participants' attention to questions, comprehension of instructions, and honesty (Peer *et al.*, 2022). This study required participants to have access to Sky (a subscription channel) which makes the sample less generalisable to the population. Fortunately, this will not be a requirement for the subsequent study.

The purposive sampling methods limit the generalisability of the study beyond young men who gamble more frequently. However, justification has been provided as to why this sample was selected. It does mean that I cannot generalise to women, for example, who may have a different behavioural response to gambling advertising. Furthermore, focusing on a representative population may be more appropriate in relation to Rose's paradigm that argues that focusing on the highest-risk individuals has its limitations. Nonetheless, each PGSI group (including 'non-problem gamblers') were represented in the sample, but by design there was a higher weighting of moderate and high-risk gamblers compared to the general population.

Finally, the choice to use a focus group rather than individual interviews may have discouraged some people from participating in this phase of the research. Of the 30 individuals invited, 10 accepted the invitation, but only 6 attended the focus group. While this low turnout is a limitation, it is likely influenced by other factors as well, such as scheduling the focus group on a pre-determined date rather than consulting participants' availability. This prevented many from attending due to prior commitments. One participant chose to engage via the chat function, suggesting that efforts to enhance inclusivity did have some impact on participation. However, there remains a risk that social pressures within the group may have led some individuals to conform to the most common opinions, potentially limiting the diversity of viewpoints (Clark *et al.*, 2021).

4.5.5 Changes to the Study Design in Chapter Five

Following on from this study, a number of adjustments to the study methodology were implemented for the final study in chapter five of this thesis:

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1. No collection of betting account transaction data took place due to the cost of this data verses the quality of the data it provides.
2. Instead of having closed response questions, an open box response in the style of a betting diary was used in the study in Chapter Five. This was to eliminate any confusion over the type of bet that respondents should report, and to allow for a more accurate representation of the time of the bet (since betting account transaction data was not collected). Further instructions on how to fill in this diary, and what types of bets to report, were used to minimise recall bias.
3. The reimbursement schedule was adjusted to reflect an escalating payment scale to maximise retention.

4.6 Chapter Conclusion

This study tested the feasibility of collecting longitudinal betting data during a global sporting event to inform a future quasi-experimental study. It revealed that men are actively involved in football betting which enhances their engagement in this type of research. For the most part, the findings confirm the feasibility of the methods and contribute to the development of the surveys to ensure that the number, and type of bets are more accurately measured. However, the feasibility and value of collecting individual betting transaction data is limited due to the complexity of sports betting and the unwillingness of participants to share this data, suggesting that alternative methods should be explored in future research. These results feed directly into the following chapter which reports the results of a quasi-experimental study measuring the impact of television advertising on betting behaviour during the 2022 Qatar FIFA World Cup.

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Chapter Five: The effect of TV advertising on gambling behaviour: a quasi-experimental study during the 2022 Qatar FIFA World Cup

5.1 Chapter Overview

Chapter Four described a small feasibility study. This chapter describes a more substantial study that explored the impact of television gambling advertising on gambling behaviour in a high-risk population group. It describes the methods and results and discuss the implications of results considering its strengths and limitations.

5.2 Aim and Research Questions

This study aims to fill an important evidence gap in gambling advertising research by using a quasi-experiment to estimate the impact of television gambling advertising on gambling behaviour amongst a higher-risk group of gamblers. It uses longitudinal betting surveys during the group stages of the 2022 Qatar FIFA World Cup. The study exploits the variation in gambling advertising between two broadcasters – Independent Television (ITV) and The British Broadcasting Corporation (BBC) – to better identify causality in a real-world setting. The primary and secondary research questions are:

> *RQ1: Are a higher number of football bets placed during a game televised on ITV (gambling adverts) compared to BBC (no gambling adverts) amongst a high-risk population group?*

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RQ2: Is there a dose-response effect, i.e. does a higher frequency of gambling advertising have an increasing effect on the number of football bets placed during the game by a high-risk population group?

5.3 Methods

5.3.1 Rationale

The literature examining the relationship between gambling advertising and gambling behaviour indicates that advertising is positively associated with gambling behaviour (Chapter Three). These effects appear to be more pronounced in higher risk gamblers. However, most studies have explored this relationship using observational methods which are less able to establish causal relationships. This is partly because the relationship between advertising and behaviour is complex; controlling for exposure to advertising is challenging. In observational studies there are issues with endogeneity, specifically reverse causality, which may bias estimates. This describes the problem that people who gamble more on sports might be more likely to watch sports and therefore be more exposed to advertising, at the same time as watching sports and being more exposed to advertising might increase someone's betting on sports. It can be difficult to identify the direction of causality in an observational study. In experimental studies, of which some exist in the sports-related advertising literature (Rockloff *et al.*, 2019; Houghton and Moss, 2020; Roderique-Davies *et al.*, 2020; Di Censo, Delfabbro and King, 2023), researchers can directly control for advertising exposure providing stronger internal validity. This permits demonstrations that the exposure caused the outcome, thus identifying the direction of causality. However, this often occurs in unrealistic settings, lacking contextual factors that may be important for betting, and raising concerns about the external validity of results. Natural experiments are a form of quasi-experimental method that identify a source of external ("exogenous") variation in the explanatory variable (i.e. advertising) which influences the outcome variable (i.e. betting). In this context, a quasi-experimental study would need to identify something that is directly related to gambling advertising, but not to gambling behaviour. These types of studies can overcome the limitations of both observational and experimental studies. They are often used to analyse policies and can identify causal influences in naturalistic settings. Examples include the analysis of the smoking ban in the UK (Adda,

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Berlinski and Machin, 2007; Jones *et al.*, 2015), and the analysis of the Transport for London 'junk food' advertising ban (Yau *et al.*, 2022).

5.3.2 Design

5.3.2.1 Quasi-Experimental Setup

Television rights to the 2022 Qatar FIFA World Cup were awarded to ITV and BBC: two free-to-watch television channels in the UK. Since the BBC is predominantly funded by a UK household licence fee, it does not show commercial advertising. Conversely, ITV sells advertising slots around its programmes. This creates an external variation in gambling advertising between the two broadcasters. In this case, the broadcaster can be used as a proxy for gambling advertising in the statistical model to eliminate the reverse-causation problem of observational studies. A proxy variable must be related to the variable of interest; ITV has a positive relationship with gambling advertising. However, the proxy must not be related to the error term, or the model will become endogenous, and coefficients may be biased. ITV must not be independently associated with gambling behaviour, aside from its relationship with gambling advertising.

To support this, Figure 8 presents a causal loop diagram outlining the quasi-experimental setup. The key confounding variables include individual-level characteristics, such as demographic and gambling-related characteristics, the influence of match characteristics and exposure to other forms of advertising.

A model relying on self-reported exposure to television advertising as the primary explanatory variable is susceptible to reverse-causality. This is because gambling behaviour is closely linked to certain demographics. For instance, younger men are both more likely to watch sport (YouGov, 2024) and more likely to engage in gambling (Public Health England (PHE), 2023; The National Centre for Gambling Research (NatCen), The University of Glasgow and The Gambling Commission (UK), 2023), which increases their exposure to gambling advertisements. Similarly, individuals experiencing gambling harms may watch more football due to their interest in gambling, again increasing their likelihood of exposure to such advertising. These same traits (age, sex, and gambling history) are also strongly associated with gambling behaviour itself, making it difficult to untangle cause and effect. Furthermore, it's difficult to isolate the impact of television

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advertising alone, given that people are also exposed to various other forms of advertising both online and in-person.

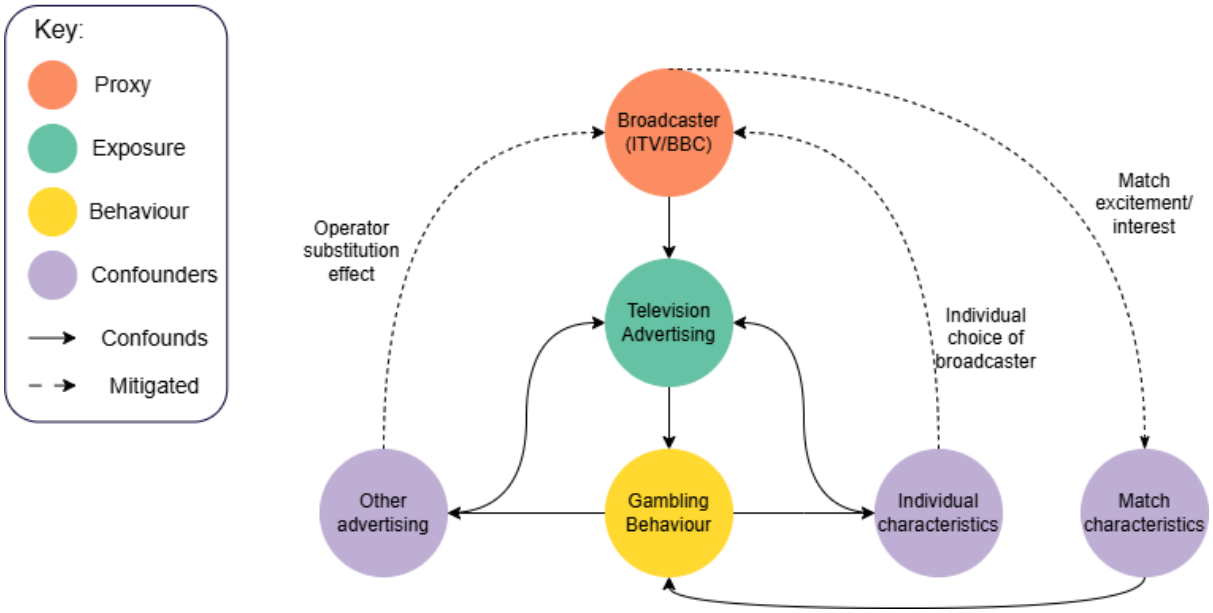

Figure 8: A causal loop diagram representing the quasi-experimental setup

By contrast, the quasi-experimental design leverages variation in broadcaster assignment to overcome these limitations. Since the only systematic difference between the broadcasters is their commercial advertising, and individuals have no choice over which broadcaster televises a specific game, this setup helps isolate the impact of television advertising on gambling behaviour. This design also minimises the influence of individual demographic or behavioural characteristics on exposure, since viewers don't self-select into ITV or BBC broadcasts which they may do in other circumstances.

Nonetheless, we must consider a few residual risks of confounding. There is still a small chance that ITV and BBC viewers differ in their characteristics. However, the data suggest this is not a significant concern, as most respondents reported watching games on both channels at some point in the tournament, indicating broadcaster assignment was effectively random for most viewers - see the results section for a comparison of ITV and BBC viewer characteristics.

Another potential risk is that operators may shift visual advertising from restricted TV slots to other in-game visuals, such as pitch-side advertising. However, this risk is limited

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since the tournament was held in Qatar where gambling is illegal and in-game advertising for gambling operators is technically prohibited. Only one instance of pitch-side gambling advertising was recorded during a single broadcast, involving an operator that had not yet officially been launched in the UK at the time of the tournament.

While advertisers may theoretically substitute with other forms of advertising, such as direct advertising, the risk is anticipated to be low. Different advertising formats serve different strategic purposes, with direct and online adverts typically offering more personalised targeting towards individual bettors. It is more plausible that operators may have increased TV advertising in the post-game section of ITV broadcasts that preceded BBC broadcasts, to offset the restricted advertising opportunities.

The only remaining concern is therefore whether one broadcaster selects the most important, or exciting, football games which might result in the proxy variable being associated with gambling behaviour. Allocation of the matches between broadcasters is pseudo-random. This means that it has not been randomised, but the allocation of games mimics a randomised pattern. Broadcasters would prefer the most popular selection of football matches, for example, England games. However, this is not optimal given their television schedules. Certain programmes attract large viewing figures for the BBC (e.g. Strictly Come Dancing) and ITV (e.g. Saturday Night Takeaway). Each broadcaster can use this to their advantage to negotiate important matches which clash with the opponent's television schedule. The allocation of matches is ultimately determined by negotiations which maximise viewership for both channels. Consequently, the distribution of matches mimics a randomised pattern, despite being assigned deterministically. The differences between matches have been discussed in more detail, to support the pseudo-random assumption, in the descriptive section of the results.

In summary, the quasi-experimental design offers a strong and reliable framework that substantially mitigates concerns about reverse causality and confounding factors. This increases confidence that the observed behavioural changes are driven primarily by differences in television advertising exposure between the two broadcasters, rather than by external or individual-level factors.

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5.3.2.2 Gambling Advertising Around Live Sports in the United Kingdom

Gambling advertising is predominantly industry-regulated in the United Kingdom, and industry advertising codes permit television advertising for sports betting products during the day, providing they occur around live sports programmes (Industry Group for Responsible Gambling, 2023). This context provides a unique opportunity to isolate the impact of television gambling advertising on gambling behaviour using ITV as a proxy for the presence of television gambling adverts in the statistical model, since these programmes should include gambling advertising during the day.

It is important to note that advertising around live sport is subject to the industry-implemented 'whistle-to-whistle' (W2W) advertising ban, introduced in August 2019. This restricts television advertisements to the pre and post-game sections of live sports programming. Advertisements are not permitted in the 5-minutes before the first whistle of a live game, during any half-time or intermittent break periods, or in the 5 minutes after the final whistle of a live game. Nonetheless, advertising is still permitted during the build-up to the live match and following the end of the match. This is discussed in more detail in the results and discussion section of this chapter.

5.3.3 Participants

See Table 8 for the inclusion and exclusion criteria for participants. The inclusion criteria are identical to that in Chapter Four, except the study has been restricted to participants living in England due to the potential regional variation in television advertising, and there is no requirement for participants to have access to Sky. As previously outlined, all studies involving primary data collection (Chapters Four to Six) use purposive sampling due to budget constraints. Participants were selected based on high levels of gambling involvement, with particular emphasis on groups identified in existing research as more vulnerable to gambling-related harm as measured using the PGSI - specifically younger adults and men. However, not all included participants were high risk; many were at no or low risk of gambling-related harm, ensuring representation across the full spectrum of gambling behaviour consistent with a population-centred approach.

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Table 8: Inclusion and exclusion criteria for quasi-experimental study

Inclusion Criteria	Exclusion Criteria
Sex: males Age: 18 to 45 Gambling: regular football gamblers (at least once in the last 12 months) Geographical location: England Other: Planning to watch some of the World Cup group-stage games.	Gambling: A history of, or currently being treated for, personal gambling problems

5.3.4 Sampling

This study uses purposive sampling methods, which are commonly used in gambling advertising research (Russell *et al.*, 2018; Browne *et al.*, 2019; Hing *et al.*, 2019; Lopez-Gonzalez and Griffiths, 2021). Over-sampling higher-risk gamblers ensures that they are sufficiently represented in the dataset (Hing *et al.*, 2015). These individuals are important subgroups for policy makers, given their greater vulnerability to gambling harms. This study maximised sample size, given resource constraints. This was judged to be appropriate given there were no issues with recruitment and retention in the feasibility study.

5.3.5 Recruitment

5.2.5.1 Recruitment Platform

Recruitment was undertaken in Prolific, an online panel of potential participants. Despite criticisms that panels may produce biased samples (Pickering and Blaszczynski, 2021), they often foster the collection of a larger amount of higher quality data (Peer *et al.*, 2022). Prolific monitors its respondents, allowing researchers to report those providing false or low-quality data, and to withhold payment where necessary. It also allows participants to report researchers, for example, who are not sufficiently reimbursing them for a study. Prolific maintains participants' anonymity throughout the study using an ID and allows the researcher and respondent to keep contact through an online messaging system. Reimbursement occurs directly through Prolific which saves time and ensures trust between the researcher and participant; the payment must be in the researchers

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account before they are allowed to collect the data, to ensure they have sufficient funds to pay their participants. These characteristics made Prolific a suitable platform for recruiting a sample for this study.

Survey responses were collected in Qualtrics, an online survey platform that is approved for use within the University of Sheffield and can be linked directly to Prolific. Participants are sent a Qualtrics link through Prolific, and the researcher is notified when they have completed this survey, including information on how long it took them to complete it. This platform was judged to be suitable given that it was used for the feasibility study and no issues were identified.

5.2.5.2 Recruitment Process

A sample of 1000 individuals were invited to screening based on the characteristics stated above on 14th November 2022. A larger sample was selected for screening to allow for the fact that many people may not have been eligible, may not have consented, or may not have responded if invited to the full study. Prolific invited a pool of potential participants based on a short description provided by the researcher:

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*"You have been invited to a screening survey for a study exploring the betting behaviours of men during the Qatar 2022 World Cup group stage games. This research will take place from the **14th November to 12th December 2022**, and will require participants to complete **13 daily surveys** measuring their football betting, as well as a **baseline and follow-up survey**. Each survey is expected to take approximately **10-12 minutes each.***

*If participants complete all surveys, the total reimbursement for this study will be **£35.** It is anticipated that this research will take **approximately 3 hours** per participant over the 4 week period (£11.60 per hour). There is the option for a smaller (selected) sample of participants to receive an additional £10 at the end of the study if they are willing to take part in a focus group.*

*This research forms part of a wider PhD looking at gambling and football. If you are interested in taking part in this study, please complete the screening survey. Please note that **the screening survey does not guarantee participation**. If you are not selected to participate in this study, you will be reimbursed £0.75 for your time."*

During the recruitment process, participants were provided with a detailed information sheet and consent form and were given the opportunity to ask further questions about

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the study. Those who were eligible and fully consented to the study were invited to the study based on their self-reported gambling frequency, with highest-reported frequency being the primary sorting criterion followed by time of response (see Chapter 4, section 4.3.5 for further details on the sample selection process).

5.2.6 Surveys

On 17th November 2022, participants were invited to complete a baseline survey which collected basic demographic and gambling data. They were then invited to complete daily surveys between 21st November 2022 and 3rd December 2022: each referring to the previous match day. The sample of matches was limited to the group stages of the tournament primarily due to financial, resource and design limitations (the final match was televised on both ITV and BBC which would have permitted a choice of broadcaster for individuals). Therefore, the study covered a total of 48 matches over 13 days. Surveys were released at 9am and remained open for 48 hours after this. Once the survey was closed, participants were not able to respond to it. This reduced the risk of recall bias by ensuring participants were only recalling a maximum of 48 hours prior to the survey.

Survey questions collected data on whether the participants watched, and / or bet on, the live games, the other ways in which they followed the live games (radio, betting apps, social media, news feeds & other), and what football bets they placed on that day. Participants were given detailed instructions to provide information about all the football bets that they had placed on the previous day, providing evidence of the bet detail, the timing of the bet in hours and minutes (using a 24-hour clock), and the operator they placed the bet with. They were presented with free-text boxes to input this information and were asked to provide a broad summary of the bet placed (see Figure 9). The bet detail was not important to this study, but was included to help participants correctly report their bets. An example of the betting survey is shown in Figure 9.

A follow-up survey was released on 5th December which provided them with the chance to offer feedback on the study, and asked some final questions about their betting over the study. For a detailed description of the survey questions please see Appendix 3 Tables 3 to 4. Respondents were anonymised throughout the entire study using their Prolific ID and were blinded to the true aim of the research project throughout.

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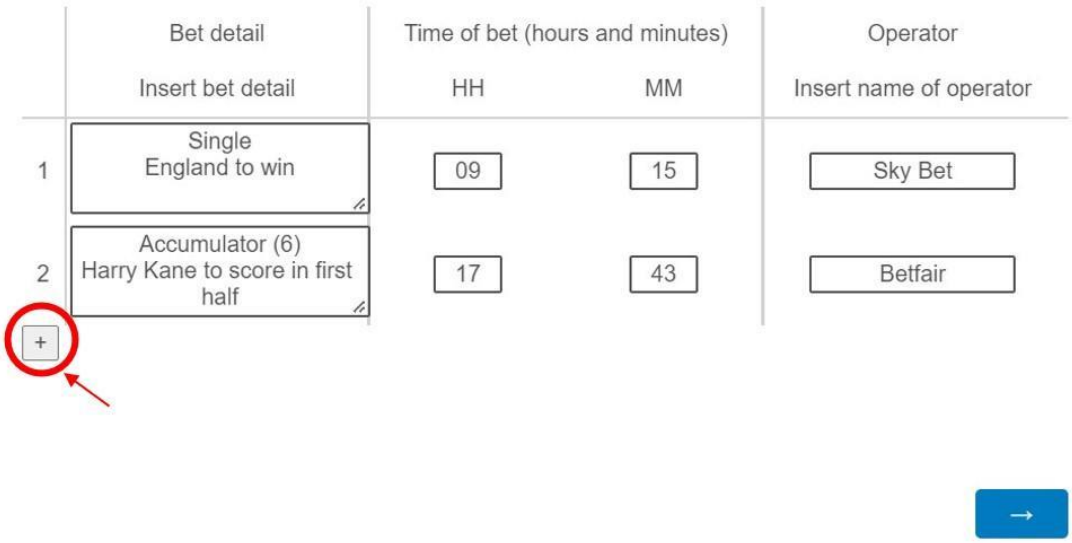

Figure 9: An example of the betting survey

5.2.7 Focus Group

After the surveys, a smaller number of participants (n=10) were invited to a focus group on 12th December. This took place online (Google Meetings), it lasted 45 minutes, and participants were offered additional reimbursement for this (see Table 9). They were also given a new information sheet and consent form. This focus group was intended as a reflective exercise to obtain feedback from participants in addition to the open box feedback question in the follow-up survey. It was used to identify any major issues with completing the survey, in case this were to impact the data. The focus group data was not formally analysed due to time constraints and given that it was intended as a reflective exercise. A short narrative reflection has been included in the supplementary analysis section of this chapter.

5.2.8 Reimbursement

The maximum reimbursement was £35 per-participant, contingent on the number of surveys completed. Individual survey reimbursement increased throughout the study ranging from £1.50 to £3.50 per survey (Table 9), based on the findings in Chapter Four. Each reimbursement was contingent on completing the survey, as indicated in Prolific. This level of reimbursement was sufficient given the time requirements of the study but was not anticipated to be too large to encourage people to take part when they otherwise

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would not have done so. Each survey was expected to take between 10 and 15 minutes; 15 surveys taking a maximum of 3 hours over the entire study equates to approximately £11.67 per hour. This considered that some surveys might take longer to complete if the participant had placed several bets on that day. Participants were aware of the reimbursement schedule prior to taking part in the study.

Table 9: Reimbursement schedule for the quasi-experimental study

Survey Date	***Detail***	***Reimbursement***
17th November	Baseline	£1.50
21st November 2022	Qatar Vs Ecuador - **BBC**	£1.50
22nd November 2022	Senegal Vs Netherlands - **ITV** England Vs Iran - **BBC** USA Vs Wales - **ITV**	£1.50
23rd November 2022	Argentina Vs Saudi Arabia - **ITV** Denmark Vs Tunisia - **ITV** Mexico Vs Poland - **BBC** France Vs Australia - **BBC**	£2.00
24th November 2022	Morocco Vs Croatia - **ITV** Germany Vs Japan - **ITV** Spain Vs Costa Rica - **ITV** Belgium Vs Canada - **BBC**	£2.00
25th November 2022	Switzerland Vs Cameroon - **ITV** Uruguay Vs South Korea - **BBC** Portugal Vs Ghana - **ITV** Brazil Vs Serbia - **BBC**	£2.00
26th November 2022	Wales Vs Iran - **BBC** Qatar Vs Senegal - **BBC** Netherlands Vs Ecuador - **ITV** England Vs USA - **ITV**	£2.00
27th November 2022	Tunisia Vs Australia - **BBC**	£2.50

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	Poland Vs Saudi Arabia - **ITV** France Vs Denmark - **ITV** Argentina Vs Mexico - **ITV**	
28th November 2022	Japan Vs Costa Rica - **ITV** Belgium Vs Morocco - **BBC** Croatia Vs Canada - **BBC** Spain Vs Germany - **BBC**	£2.50
29th November 2022	Cameroon Vs Serbia - **ITV** South Korea Vs Ghana - **BBC** Brazil Vs Switzerland - **ITV** Portugal Vs Uruguay - **ITV**	£2.50
30th November 2022	Ecuador Vs Senegal - **ITV** Netherlands Vs Qatar - **ITV** Iran Vs USA **- BBC** Wales Vs England - **BBC**	£2.50
1st December 2022	Tunisia Vs France - **BBC** Australia Vs Denmark - **BBC** Poland Vs Argentina - **BBC** Saudi Arabia Vs Mexico -**BBC**	£3.00
2nd December 2022	Croatia Vs Belgium - **BBC** Canada Vs Morocco - **BBC** Japan Vs Spain **- ITV** Costa Rica Vs Germany - **ITV**	£3.00
3rd December 2022	South Korea Vs Portugal **BBC** Ghana Vs Uruguay - **BBC** Serbia Vs Switzerland -**ITV** Cameroon Vs Brazil - **ITV**	£3.00
5th December 2022	Follow-up	£3.50
12th December 2022	Focus group	£10

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5.2.9 Live Recordings

The frequency of gambling advertisements on television were counted using live recordings of games on Box of Broadcasts (BoB), a method used in other studies (Newall, Walasek and Ludvig, 2019; Newall, Ferreira, *et al.*, 2022). Advertisements were counted from the first advertising break after the start of the broadcast, to the final advertising break after the end of the broadcast. Gambling advertisements were coded into New Gambling Products (NGP), a term used by the industry in their advertising codes (IGRG, 2023). These included everything except lottery and bingo, since these are regulated differently. Any remaining non-gambling adverts were coded as 'Other'. Live broadcasts typically spanned up to an hour before the game, and up to 30 minutes after the game.

5.2.10 Dependent Variables

The dependent variable was the number of football bets placed 'during the game'. Football bets were categorised as 'during the game' if they occurred within a window of minutes around the live match: 60, 30, 15 and 10-minute windows either side of the game, including the game itself. These bets did not have to be placed on the live game in question but had to occur within the time window specified. This was based on the W2W ban; it was anticipated that there would be no NGP adverts occurring during the W2W period, and so this study manipulated the window around the live game. There is no evidence for the optimal window around a live football game where advertising is most effective, so this study reports analysis using four different windows to explore whether window choice impacts results.

The decision to focus on the frequency of bets placed, rather than alternative measures such as total gambling expenditure, was based on the view that it most reflects the likely causal mechanism through which advertising prompts behaviour, namely, the placement of an additional bet. While expenditure can be meaningful, it may be confounded by external factors such as individual income. For example, a substantial increase in spending may represent only a small fraction of a high-income individual's budget, making it less informative as an indicator of behavioural change. The lower-risk gambling guidelines in Canada and Australia suggest that expenditure is interpreted best as a percentage of income (Dowling *et al.*, 2021; Young *et al.*, 2024; Canadian Centre on Substance Use and Addiction, 2025; Gambler's Help and Victoria State Government,

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2025). In contrast, placing an additional, unplanned bet more likely reflects spontaneous behaviour triggered by advertising, especially in the context of in-play betting, where the individual may not have fully considered the risks and may therefore be at risk of financial or other gambling-related harms (Hing *et al.*, 2018). Consequently, bet frequency is used as the primary behavioural variable in this thesis.

5.2.11 Independent Variables

The key independent variable is a binary variable equal to 1 if the game was televised on ITV, and 0 if the game was televised on BBC: a proxy for gambling advertising. To supplement the quasi-experimental analysis, exploratory analysis used two variables in place of the ITV variable:

1. a count of the frequency of gambling adverts present within the specified window;
2. a binary variable which indicates whether there was at least one gambling advert present within the specified window.

The latter analysis was completed due to an absence of NGP adverts in the narrower windows, especially the 10-minute window. In this case, some of the ITV games are equal to BBC (0 gambling advertisements on television). The latter measure accounts for this.

Frequency of advertising was selected as the most appropriate measure of exposure, given the uniform duration of gambling advertisements (approximately 30 seconds each) and the underlying assumption that it is the content of the advert, rather than its duration, that drives the behavioural impact. As such, the total number of exposures provides a more behaviourally meaningful indicator than cumulative advert time. Each individual exposure represents an opportunity for the advertising message to exert an effect. Additionally, frequency is easier to interpret and analyse compared to a continuous measure such as total advert time. Participants may also be more willing to share their frequency of gambling rather than their expenditure as there may be less shame or stigma around this. This rationale underpins the decision to focus on advertising frequency throughout the remainder of the thesis, particularly in Chapters Seven and Eight.

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5.2.12 Match-Level Controls

The differences in match characteristics between broadcasters, such as the excitement of the match, are described in the results section. However, a number of match-level controls have been included in the statistical model to strengthen the analysis by controlling for other variables that might impact betting other than gambling advertising These include:

1. whether the participant self-reported watching the game;
2. whether it was televised in the evening;
3. whether it was televised over the weekend (Saturday or Sunday);
4. whether it was an England game;
5. whether it was included in the Broadcasters Audience Research Board (BARB) top viewed television programmes for that week;
6. whether the respondent had already placed a bet on the match;
7. a count variable of the other ways they had followed the match (e.g. online, betting apps, radio);
8. the length of the match in minutes;
9. and the absolute difference in October 2022 FIFA rankings (see Appendix 3 Table 7) between the two countries playing against each other.

It was anticipated that betting frequency would be higher when participants self-reported watching a game, when the match involved England, if they had placed a bet on the match already, if the game was televised in the evening or on a weekend, if they were following the match in more than one way, and if the match was longer. Length of the match is included in the model, rather than the length of the programme, because longer matches broaden the opportunity to bet and length of the programme is directly correlated with the ITV (advertising) variable. The difference in FIFA rankings measures how certain, or expected, the outcome might be; If the countries are closer in ranking, then the outcome is more uncertain. The higher uncertainty might deter betting due to the increased risk, or encourage betting due to the higher potential win. Similarly, games that are more highly viewed might attract more or less betting depending on whether match enjoyment and interest encourages or deters betting. Some research would suggest that people are motivated to bet on sports to make a live game more exciting

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(Killick and Griffiths, 2021). Other research suggest that social factors play a bigger role, and that it might the excitement, or thrill, of winning that drives young men's sports betting behaviours, rather than the excitement of a game (Fang and Mowen, 2009; Lamont and Hing, 2020). Viewing figures for the games were not freely available unless the match entered the top viewed programmes for that week. Therefore, a dummy variable was created, indicating whether the game was one of the 'top viewed' in that week, as a proxy for match interest. A dummy variable for whether the game was a Wales match was not included because the sample was from England.

5.2.13 Statistical Analysis

This study uses Fixed Effects panel data models to account for individual differences in betting. The panel is set at the individual (n=365) and match (n=48) level. It employs a Poisson model to account for the count nature of the data, and a Logistic regression model for comparison. The rationale behind the model is that there should be no difference in betting between games on ITV and BBC once the pseudo-randomised allocation of matches, the inclusion of match-level covariates, and individual differences (i.e. fixed effects) are taken into account. Any difference observed must be due to the variation in television gambling advertising between the two broadcasters. The model should isolate the effect of gambling advertising on the betting outcome. For the main analysis, participants who did not respond to all surveys were dropped from the sample to ensure a balanced panel. The protocol for this analysis, including any adjustments, has been preregistered on the Open Science Framework (See Appendix 3.2; McGrane *et al.*, 2023). Analysis has been undertaken in STATA 17.

5.2.14 Supplementary Analysis

Several supplementary analyses were performed to support the main results:

1. Testing for differences between windows of exposure: To test whether the effect of advertising varied across different time windows around the live game, I employed pooled regression models containing an interaction term between ITV and exposure window. I formally tested for statistically significant differences between the magnitude of effect size in all windows and specific windows (60-minute vs 30-minute, 30-minute vs 15-minute and 15-minute vs 10-minute).

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2. Exclusion of safer gambling advertisements from the models: Safer gambling advertisements, an industry commitment that encourage 'responsible' gambling practices (e.g. setting limits, or taking a break from gambling), were included in the primary dose-response models as gambling advertisements. This is because most standard gambling advertisements embed safer gambling messaging, usually in the form of the slogan such as "When the Fun Stops, Stop" (van Schalkwyk *et al.*, 2021; Newall *et al.*, 2022), making clean separation difficult. Nonetheless, supplementary models have been estimated excluding these advertisements to test the robustness of the findings. Furthermore, additional models included safer gambling advertisements as a separate regressor to determine whether they have an independent association with gambling behaviour.
3. Subgroup analysis: To explore heterogeneity in effects, separate subgroup models were estimated based on income, mental health, gambling risk level and age. This permitted the assessment of differential impacts across key demographic and behavioural groups.
4. Threshold models: In addition to the main dose-response models, I tested threshold models to examine whether the effects of advertising emerge after a certain level, rather than increasing incrementally with each additional advertisement. Various thresholds were explored across each exposure window to identify the cut-off point.
5. Additional supplementary analysis: I reported the main causal (ITV) models for people reporting watching the games. Additionally, descriptive dose-response models were estimated using ITV games only to assess whether this impacted results.

5.2.15 Ethics

This study has been approved by the University of Sheffield's Ethics Review Procedure, as administered by the Sheffield Centre for Health and Related Research (SCHARR) [049521]. Informed consent was obtained digitally from all participants in the study.

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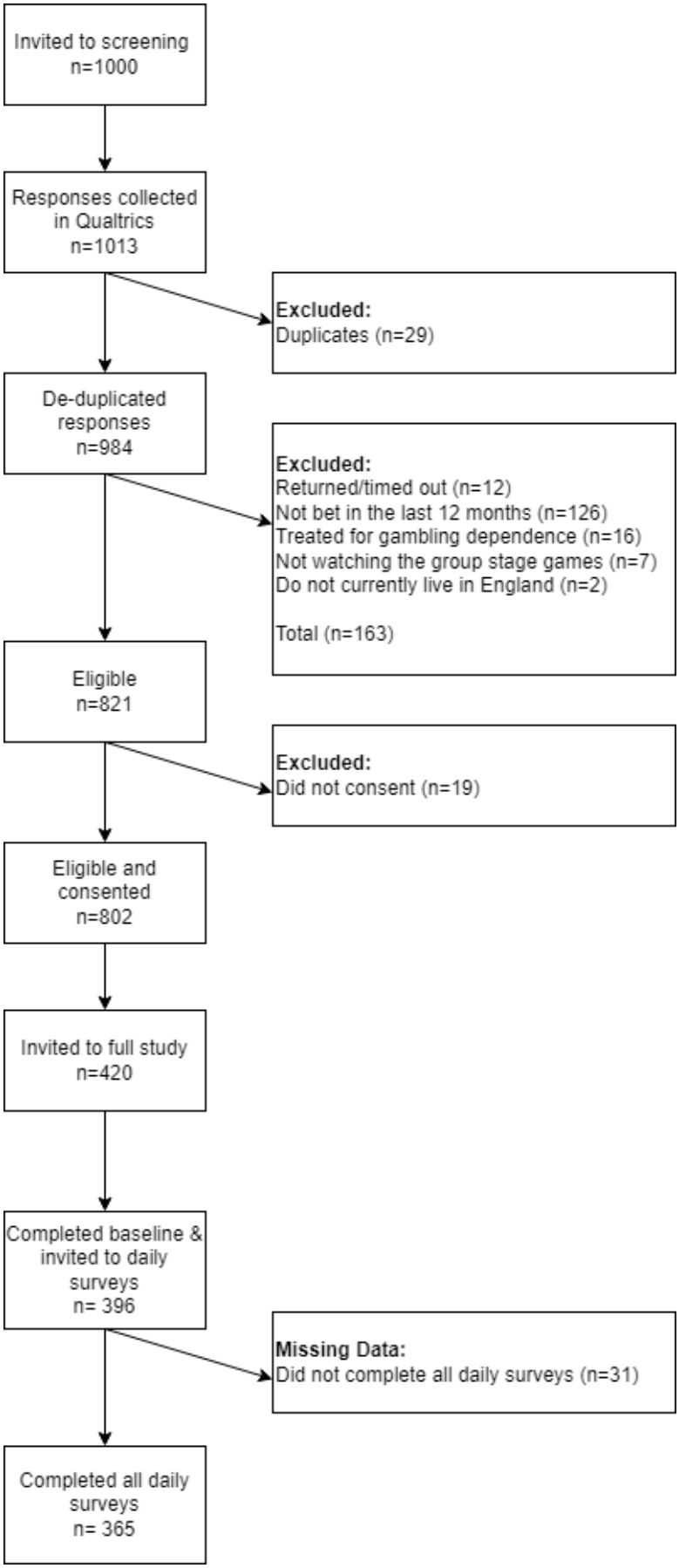

Figure 10: Recruitment and retention flow chart for quasi-experimental study

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5.3 Results

5.3.5 Recruitment

The top 400 participants with the highest football gambling frequency were invited to the study. Due to some non-response, a further 20 participants were invited 24 hours later. In total, 396 participants provided consent and completed the baseline survey before the study commenced. A total of 92% of participants had complete data resulting in a final sample of 365 (Figure 10).

5.3.6 Descriptive

5.3.6.1 Differences in Match Excitement or Interest

Table 10 provides a summary of the characteristics of live matches between broadcasters, in terms of their excitement or interest. The characteristics of live World Cup matches across broadcasters is similar. England games were televised across ITV (n=1) and BBC (n=2). Both broadcasters televised a similar number of games that entered into the top viewed programmes for that week. Broadcasters showed a similar number of games on the weekend and in the evening, and a similar proportion of respondents reported watching games on either channel. The length of matches was similar (including added time), and the expectation of the outcome as measured by the difference in FIFA rankings between the two teams playing was also similar. There were no differences in the average number of people self-reporting watching games on each channel.

ITV televised a slightly higher number of games that were the first games played by one of the top 10 teams based on the October 2022 FIFA rankings. However, the BBC televised more games that determined whether a team would progress to the next stage of the tournament. ITV televised two important games that determined whether Spain or Germany would go through, which might have attracted more interest. Comparatively, BBC televised the Wales vs England game (29th November 2022) which determined which team would progress. This was one of the most watched programmes of 2022, coming second only to the World Cup final in December (Broadcasters Audience Research Board (BARB), 2023).

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Table 10: A summary of match excitement and interest across broadcasters

Measure	Match Excitement or Interest	ITV	BBC
Frequency			
	England games	1	2
	One of the top viewed programmes of that week	12	11
	Weekend games (Saturday/Sunday)	4	5
	Evening games (7pm)	8	9
	First game played by one of the top 10 teams in the October 2022 FIFA rankings	6	4
	Determined progression to the next stage of the tournament	5	9
	Top 50 most highly viewed broadcasts of 2022	0	1
Average			
	Length of the match (including added time)	101.70	101.10
	Difference in the October 2022 FIFA rankings between the teams playing	20.70	21.20
	Self-reported watching	0.57	0.56

**Note: see Appendix 3 Table 5 for a summary of the unexpected match outcomes and the matches that determined a knock-out; Sources: BBC https://www.bbc.co.uk/newsround/63832029; BARB https://www.barb.co.uk/viewing-data/most-viewed-programmes/; https://www.barb.co.uk/insight-parent/insight-what-people-watch/what-people-watch-viewing-in-2022/; Sporting News https://www.sportingnews.com/uk/football/news/teams-out-world-cup-2022-list-nations-eliminated-fifa-2022/cmk6aexisveysdxidiq84baf; https://www.sportingnews.com/us/soccer/news/world-cup-standings-2022-table-live-updated-group-qatar/lv5qodvbdsecrwf0gwelqzn0*

In total, this suggests that the characteristics of the matches, in terms of match interest and excitement, were similar across broadcasters during the group stages of the tournament. There is no reason to believe that either broadcaster should attract a higher number of bets based on their televised matches. Therefore, aside from the presence of absence of television gambling advertising, there is no other reason to believe that matches on ITV and BBC would attract a different number of bets. See Appendix 3 Table 5 for further details on the characteristics of the matches.

5.3.6.2 Sociodemographic, Gambling, and Other Behavioural Characteristics

The baseline demographic and gambling characteristics of the sample are reported in Tables 11 and 12. As shown, nearly the entire sample reported watching at least one game on ITV and BBC across the study, meaning that the characteristics of ITV and BBC watchers were essentially identical. The mean age of participants was 33, the majority of the sample were British, and the sample spanned all regions of England. Life satisfaction was lower than the UK average (Table 11) (Office for National Statistics (ONS), 2023)

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Table 11: Sociodemographic characteristics of the quasi-experimental study

Variable	***Detail***	***Total Sample***		***Watch ITV***		***Watch BBC***	
		Mean (SD)	*Range*	*Mean (SD)*	*Range*	*Mean (SD)*	*Range*
Age		33 (7)	[18, 45]	33 (7)	[18, 45]	33 (7)	[18, 45]
Life Satisfaction		6.4 (1.8)	[0, 10]	6.4 (1.8)	[0, 10]	6.4 (1.8)	[0, 10]
		Frequency	*Percentage*	*Frequency*	*Percentage*	*Frequency*	*Percentage*
Ethnicity							
	White British or Irish	285	78%	282	78%	285	78%
	Mixed/ Multiple Ethnic Backgrounds	11	3%	11	3%	11	3%
	Asian/Asian British	30	8%	30	8%	30	8%
	Black/African/Caribbean/ Black British	18	5%	18	5%	18	5%
	Other	21	6%	21	6%	21	6%
Area of Residence							
	London	76	21%	75	21%	76	21%
	South East	52	14%	52	14%	52	14%
	North West	63	17%	63	17%	63	17%
	East England	40	11%	40	11%	40	11%
	East Midlands	32	9%	32	9%	32	9%
	West Midlands	20	5%	19	5%	20	5%
	North East	28	8%	28	8%	28	8%
	Yorkshire & Humber	29	8%	29	8%	29	8%
	South West	25	7%	24	7%	25	7%
Employment							

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	Employed	334	92%	331	91%	334	92%
	Unemployed	31	8%	31	9%	31	8%
Annual Income							
	£0-£9,999	17	5%	17	5%	17	5%
	£10,000-£19,999	28	8%	28	8%	28	8%
	£20,000-£29,999	88	24%	88	24%	88	24%
	£30,000-£39,999	93	25%	93	26%	93	25%
	£40,000-£49,999	66	18%	65	18%	66	18%
	£50,000-£59,999	25	7%	24	7%	25	7%
	£60,000-£69,999	18	5%	18	5%	18	5%
	£70,000-£79,999	10	3%	9	2%	10	3%
	>£79,999	20	5%	20	5%	20	5%
General Health							
	Very Good	81	22%	79	22%	81	22%
	Good	196	54%	196	54%	196	54%
	Fair	82	22%	81	22%	82	22%
	Bad	6	2%	6	2%	6	2%
	Very Bad	0	0%	0	0%	0	0%
Mental Health							
	Very Good	73	20%	72	20%	73	20%
	Good	167	46%	166	46%	167	46%
	Fair	106	29%	105	29%	106	29%
	Bad	19	5%	19	5%	19	5%
	Very Bad	0	0%	0	0%	0	0%

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Table 12: Gambling and other behavioural characteristics of the quasi-experimental study sample

Variable	***Detail***	***Total Sample***		***Watch ITV***		***Watch BBC***	
		Mean (SD)	*Range*	*Mean (SD)*	*Range*	*Mean (SD)*	*Range*
Weekly Bets		10 (14)	*[1, 150]*	10 (14)	*[1, 150]*	10 (14)	*[1, 150]*
Weekly Spending on Bets		£77.88 (£155.34)	[£1, £1500]	£78.22 (£155.88)	[£1, £1500]	£77.88 (£155.34)	[£1, £1500]
Number of Accounts		6 (6.5)	*[1, 49]*	6 (6.5)	*[1, 49]*	6 (6.5)	*[1, 49]*
		Frequency	*Percentage*	*Frequency*	*Percentage*	*Frequency*	*Percentage*
Gambling Risk Level							
	No risk	95	26%	95	26%	95	26%
	Lower Risk	128	35%	127	35%	128	35%
	Medium Risk	103	28%	101	28%	103	28%
	Higher Risk	39	11%	39	11%	39	11%
Existing World Cup Bet							
	Yes	217	59%	215	59%	217	59%
	No	148	41%	147	41%	148	41%
Betting Alone							
	Almost always	120	33%	119	33%	120	33%
	Most of the time	157	43%	156	43%	157	43%
	Sometimes	85	23%	84	23%	85	23%
	Never	3	1%	3	1%	3	1%
Chosen Operator							
	Betfair	41	11%	40	11%	41	11%
	Sky Bet	87	24%	87	24%	87	24%

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	Bet365	99	27%	99	27%	99	27%
	Paddy Power	31	8%	31	8%	31	8%
	Ladbrokes	24	7%	24	7%	24	7%
	Coral	16	4%	16	4%	16	4%
	Betfred	7	2%	7	2%	7	2%
	LiveScore	2	1%	2	1%	2	1%
	William Hill	49	13%	48	13%	49	13%
	Other	9	2%	8	2%	9	2%
Betting Types							
	Online betting on another sport/event	359	98%	357	98%	359	98%
	National Lottery	241	66%	239	65%	241	66%
	Online Games	198	54%	196	54%	198	54%
	Horse Races	218	60%	217	59%	218	60%
	Scratch Cards	173	47%	170	47%	173	47%
	Sports events (bookmakers)	120	33%	121	33%	120	33%
	Betting Exchange	154	42%	153	42%	154	42%
	Fruit/Slot Machines	119	33%	117	32%	119	33%
	Bingo	72	20%	71	19%	72	20%
	Football Pools	51	14%	50	14%	51	14%
	Virtual Gaming (bookmakers)	54	15%	53	15%	54	15%
	Dog Races	38	10%	38	10%	38	10%
	Table Games (Casino)	70	19%	69	19%	70	19%
	Poker in a tournament	33	9%	32	9%	33	9%
	Other events (bookmakers/phone)	22	6%	21	6%	22	6%
Alcohol Risk Level							
	Low risk	224	61%	222	61%	224	61%
	Increasing risk	109	30%	109	30%	109	30%
	Higher risk	30	8%	29	8%	30	8%
	Possible dependence	2	1%	2	1%	2	1%

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**Note: Gambling risk level measured using the Problem Gambling Severity Index (PGSI): 0 "no risk" 1-2 "low-risk" 3-7 "medium-risk" 8+ "higher-risk" (or 'problem' gambler); "Alcohol risk level measured using the Alcohol Use Disorders Identification Test (AUDIT-C): 0-4 "low-risk" 5-7 "increasing-risk" 8-10 "higher-risk" 11-12 "possible dependence". Participants could select multiple answers on the "betting types" question; *One participant responded that they had 0 betting accounts with different companies, which I have assumed means they only hold 1 account with 1 company*

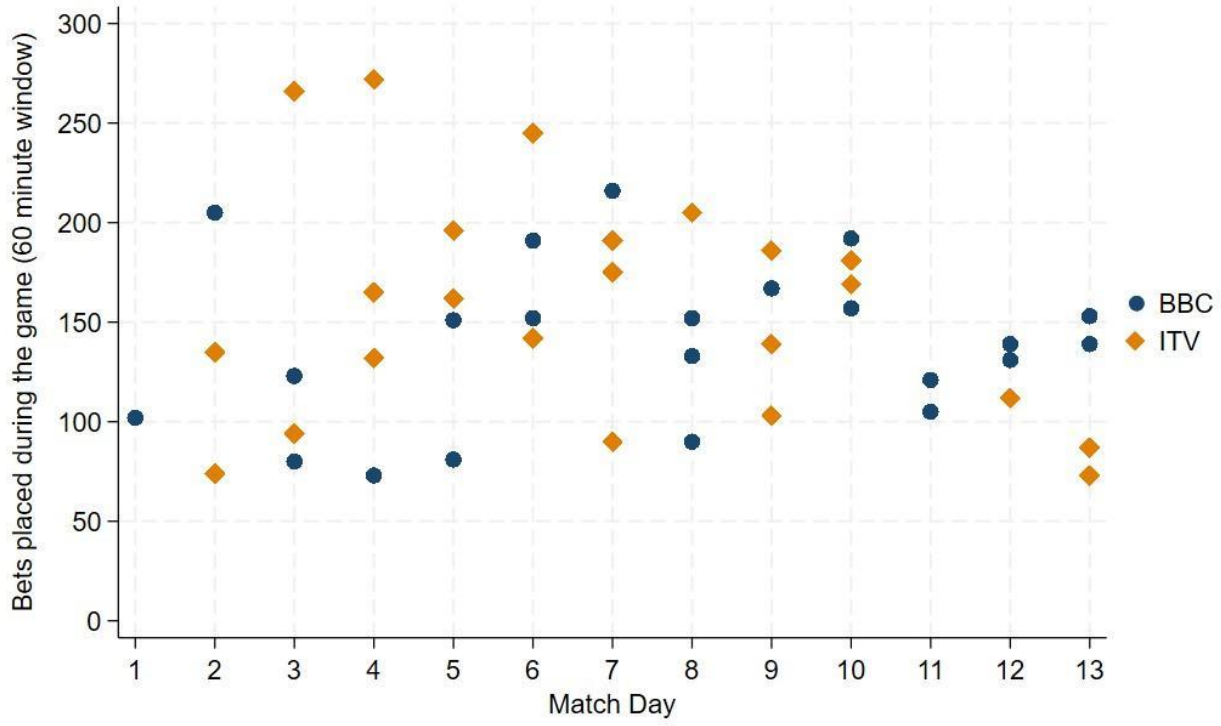

Figure 11: The frequency of television advertisements by match (60-minute window)

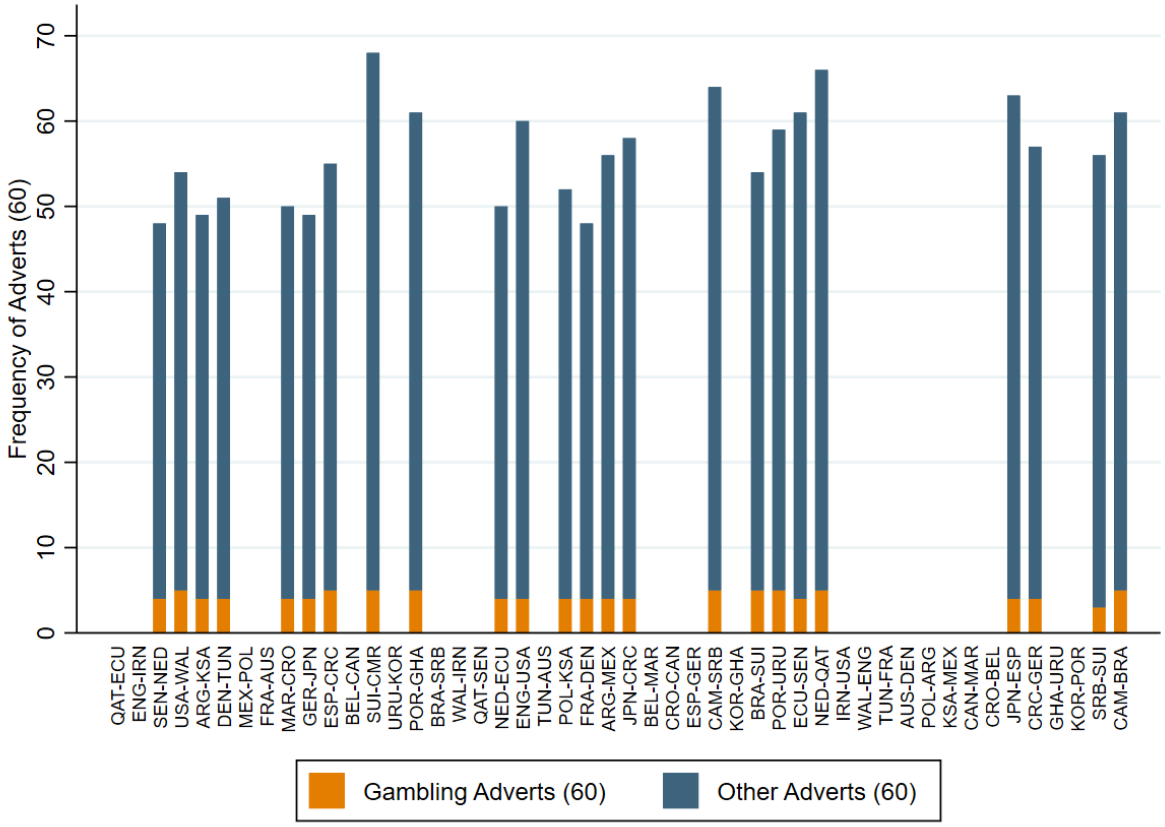

Figure 12: The frequency of bets placed 'during the game' by match day and channel (60-minute window)

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Most people reported having good general and mental health, although 5% reported having bad mental health. Participants placed an average of 10 bets per week: a mean weekly bet spend of £78 (Table 12). A higher proportion scored at medium or higher risk of gambling harm compared to the UK population: attributable to the purposive sampling techniques. The most popular activity, other than football betting, was betting on another sport. Most participants placed bets when on their own.

On average, the number of bets placed during the game appeared to be higher for games televised on ITV compared to BBC (Figure 11). There was variation in the number of gambling advertisements present across games (Figure 12); advertisements ranged between 4 and 6 per game, with the majority occurring in the pre-match build up. Advertising content varied from simple branded adverts, to adverts with specific, time-contingent odds and promotions on the upcoming match.

5.3.7 Poisson Models

Table 13: Poisson regression model using the broadcaster (ITV) as the main explanatory variable

	Poisson 60	**Poisson 30**	**Poisson 15**	**Poisson 10**
ITV	**1.16*** **	**1.16*** **	**1.21*** **	**1.24*** **
	[1.07,1.25]	**[1.05,1.29]**	**[1.07,1.38]**	**[1.07,1.43]**
Watch	1.09	1.10*	1.12*	1.15**
	[0.98,1.21]	[0.98,1.24]	[0.99,1.27]	[1.01,1.31]
Weekend	0.97	0.94	0.94	0.92
	[0.89,1.07]	[0.84,1.04]	[0.82,1.07]	[0.80,1.07]
Evening	0.60***	0.67***	0.57***	0.51***
	[0.53,0.69]	[0.55,0.81]	[0.45,0.73]	[0.39,0.68]
England	1.41***	1.39***	1.23*	1.09
	[1.24,1.61]	[1.17,1.65]	[0.99,1.53]	[0.86,1.38]
Top Views	0.80***	0.75***	0.77***	0.77***
	[0.74,0.87]	[0.68,0.82]	[0.70,0.85]	[0.69,0.85]
Match Length	1.01*	1.01	0.99	0.99
	[1.00,1.02]	[0.99,1.02]	[0.98,1.01]	[0.98,1.01]
Bet on Match	1.64***	1.47***	1.28***	1.21**
	[1.45,1.87]	[1.29,1.68]	[1.11,1.48]	[1.04,1.41]
Follow Match	1.08**	1.05	1.06	1.05
	[1.02,1.15]	[0.98,1.14]	[0.98,1.16]	[0.96,1.16]
Diff in FIFA Ranking	1.00	1.00	1.00**	1.00*
	[1.00,1.00]	[1.00,1.00]	[1.00,1.01]	[1.00,1.01]
Observations	16656	16320	15936	15792

*Note: Key explanatory variable is a binary variable for the broadcaster (1 "ITV" 0 "BBC"); Coefficients are Incidence Rate Ratios (IRR) showing the change in the frequency of football bets placed 'during the game'; Models use robust standard errors; Confidence intervals in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01*

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Participants placed a higher frequency of football bets across all windows during games televised on a channel with gambling advertising (ITV) compared to one without gambling advertising (BBC) after including an individual fixed effect, and 9 match-level controls. All results were statistically significant, and coefficients increased as the windows around the game become narrower; there were between 1.16 and 1.24 times more football bets placed when games were televised on ITV compared to BBC [IRR: 1·16 – 1·24,p<0.01] (Table 13). Watching the game was positively associated with betting across all windows. There was a reduced frequency of betting for games shown in the evening, and those with higher views. A greater frequency of football bets were placed on England games, and games on which respondents had already placed a bet. There were no changes to bets placed during the game as countries grew closer in ranking, and therefore the outcome might have been less certain.

Table 14: Poisson regression model using the frequency of gambling advertisements in the specified window as the main explanatory variable

	Poisson 60	**Poisson 30**	**Poisson 15**	**Poisson 10**
Freq Gambling Ads	**1.01**	**1.11*** **	**0.94***	**0.94**
	[0.94,1.08]	**[1.03,1.20]**	**[0.88,1.01]**	**[0.79,1.13]**
Freq Other Ads	1.00	0.99*	1.01**	1.01**
	[0.99,1.01]	[0.99,1.00]	[1.00,1.02]	[1.00,1.01]
Watch	1.09	1.11	1.12*	1.15**
	[0.98,1.21]	[0.98,1.24]	[0.99,1.27]	[1.01,1.31]
Weekend	0.97	0.91*	0.94	0.92
	[0.89,1.07]	[0.82,1.02]	[0.82,1.08]	[0.80,1.06]
Evening	0.60***	0.67***	0.56***	0.51***
	[0.52,0.69]	[0.55,0.82]	[0.44,0.72]	[0.38,0.68]
England	1.40***	1.35***	1.25**	1.08
	[1.23,1.60]	[1.14,1.60]	[1.01,1.56]	[0.85,1.37]
Top Views	0.80***	0.74***	0.78***	0.78***
	[0.74,0.87]	[0.67,0.81]	[0.71,0.87]	[0.70,0.86]
Match Length	1.01**	1.01	0.99	0.99
	[1.00,1.02]	[1.00,1.03]	[0.98,1.00]	[0.98,1.01]
Bet on Match	1.65***	1.46***	1.28***	1.21**
	[1.45,1.87]	[1.28,1.67]	[1.11,1.48]	[1.04,1.41]
Follow Match	1.08**	1.05	1.07	1.06
	[1.02,1.15]	[0.98,1.14]	[0.98,1.16]	[0.96,1.16]
Diff in FIFA Ranking	1.00	1.00	1.00**	1.00**
	[1.00,1.00]	[1.00,1.00]	[1.00,1.01]	[1.00,1.01]
Observations	16656	16320	15936	15792

*Note: Key explanatory variable is a count of the number of television gambling advertisements present during the specified window; Coefficients are Incidence Rate Ratios (IRR) showing the change in the frequency of football bets placed 'during the game'; Models use robust standard errors; Confidence Intervals in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01*

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Each additional advert in the 60-minute window was associated with a non-significant increase in the frequency of football bets placed (Table 14). The 30-minute window indicated a statistically significant advertising elasticity of 1·11 (p<0.01); each additional advert was associated with a 11% rise in football betting frequency. There was a negative association at the 15-minute window which did not reach standard levels of statistical significance (5%) [IRR:0.94,p<0.1], and a non-significant negative association at the 10-minute window: likely due to the scarcity of gambling adverts in these narrower windows as a result of industry advertising restrictions.

Table 15: Poisson regression model using a binary variable equal to one if there is at least one gambling advertisement present during the specified window as the main explanatory variable

	Poisson 60	**Poisson 30**	**Poisson 15**	**Poisson 10**
Gambling Advert	**1.16*** **	**1.16*** **	**1.22*** **	**1.11***
	[1.07,1.25]	**[1.05,1.29]**	**[1.07,1.38]**	**[0.98,1.25]**
Watch	1.09	1.10*	1.12*	1.15**
	[0.98,1.21]	[0.98,1.24]	[0.99,1.27]	[1.01,1.31]
Weekend	0.97	0.94	0.93	0.93
	[0.89,1.07]	[0.84,1.04]	[0.81,1.06]	[0.81,1.07]
Evening	0.60***	0.67***	0.56***	0.51***
	[0.53,0.69]	[0.55,0.81]	[0.44,0.72]	[0.38,0.67]
England	1.41***	1.39***	1.22*	1.03
	[1.24,1.61]	[1.17,1.65]	[0.99,1.51]	[0.83,1.28]
Top Views	0.80***	0.75***	0.78***	0.77***
	[0.74,0.87]	[0.68,0.82]	[0.71,0.86]	[0.70,0.86]
Match Length	1.01*	1.01	0.99	1.00
	[1.00,1.02]	[0.99,1.02]	[0.98,1.01]	[0.98,1.01]
Bet on Match	1.64***	1.47***	1.28***	1.21**
	[1.45,1.87]	[1.29,1.68]	[1.11,1.47]	[1.04,1.40]
Follow Match	1.08**	1.05	1.06	1.05
	[1.02,1.15]	[0.98,1.14]	[0.98,1.16]	[0.96,1.16]
Diff in FIFA Ranking	1.00	1.00	1.00**	1.00
	[1.00,1.00]	[1.00,1.00]	[1.00,1.01]	[1.00,1.01]
Observations	16656	16320	15936	15792

*Note: Key explanatory variable is a binary variable equal to 1 if there is at least one television gambling advertisement present during the specified window; Coefficients are Incidence Rate Ratios (IRR) showing the change in the frequency of football bets placed 'during the game'; Models use robust standard errors; Confidence Intervals in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01*

When at least one gambling advert was present within the specified window, there was an increase in the frequency of football bets placed during the game for all windows, except the 10-minute window which did not reach standard levels of statistical significance (5%) (Table 15). Coefficients varied across windows, with the 15-minute

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window exhibiting the largest effect; there were between 1.16 and 1.24 times more football bets placed when at least one gambling advertisement was present during an ITV game compared to a BBC game, or an ITV game with no advertising present in that window [IRR: 1·16 – 1·22,p<0.01].

5.3.8 Logistic Models

Table 16: Logistic regression model using the broadcaster (ITV) as the main explanatory variable

	Logit 60	Logit 30	Logit 15	Logit 10
ITV	**1.22*** **	**1.26*** **	**1.31*** **	**1.33*** **
	[1.13,1.32]	**[1.15,1.37]**	**[1.19,1.44]**	**[1.20,1.47]**
Watch	1.14**	1.10	1.12*	1.13*
	[1.02,1.26]	[0.98,1.24]	[0.99,1.27]	[0.99,1.29]
Weekend	0.97	0.96	0.96	0.98
	[0.88,1.07]	[0.86,1.07]	[0.86,1.09]	[0.86,1.10]
Evening	0.44***	0.48***	0.42***	0.37***
	[0.40,0.49]	[0.43,0.54]	[0.38,0.48]	[0.33,0.43]
England	1.90***	1.70***	1.53***	1.31**
	[1.61,2.25]	[1.41,2.04]	[1.24,1.89]	[1.04,1.65]
Top Views	0.80***	0.77***	0.80***	0.79***
	[0.73,0.88]	[0.70,0.86]	[0.72,0.90]	[0.71,0.89]
Match Length	1.02***	1.01*	1.00	1.00
	[1.01,1.03]	[1.00,1.03]	[0.99,1.02]	[0.98,1.02]
Bet on Match	1.99***	1.70***	1.43***	1.31***
	[1.79,2.20]	[1.52,1.91]	[1.27,1.62]	[1.15,1.49]
Follow Match	1.00	0.99	1.00	1.01
	[0.93,1.07]	[0.91,1.07]	[0.92,1.09]	[0.93,1.11]
Diff in FIFA Ranking	1.00	1.00	1.01***	1.01***
	[1.00,1.01]	[1.00,1.01]	[1.00,1.01]	[1.00,1.01]
Observations	16656	16320	15936	15792

*Note: Key explanatory variable is a binary variable for the broadcaster (1 "ITV" 0 "BBC"); Coefficients are Odds Ratios (OR) showing changes in the probability of placing a football bet 'during the game'; Confidence Intervals in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01*

Results for the logistic regressions were similar; the explanatory variables showed similar signs and significance. There was a statistically significant increase in the probability of placing a bet during the game, across all windows, for games televised on a channel which showed gambling advertising (ITV) compared to a channel which did not show gambling advertising (BBC) after including an individual fixed-effect and 9 match-level controls. Participants were between 1.22 and 1.33 times more likely to place a bet for a game televised on ITV, with coefficients increasing as the window around the game narrowed [OR: 1·22 – 1·33,p<0.01] (Table 16).

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Table 17: Logistic regression model using the frequency of gambling advertisements in the specified window as the main explanatory variable

	Logit 60	Logit 30	Logit 15	Logit 10
Gambling Ads 60	**1.00**	**1.20*** **	**0.97**	**1.01**
	[0.89,1.12]	**[1.09,1.32]**	**[0.90,1.04]**	**[0.86,1.18]**
Other Ads 60	1.00	0.99***	1.01***	1.01***
	[0.99,1.02]	[0.98,1.00]	[1.00,1.02]	[1.00,1.01]
Watch	1.14**	1.10	1.12*	1.14**
	[1.02,1.27]	[0.98,1.23]	[0.99,1.28]	[1.00,1.30]
Weekend	0.97	0.91	0.96	0.97
	[0.88,1.07]	[0.82,1.02]	[0.85,1.08]	[0.86,1.10]
Evening	0.44***	0.49***	0.42***	0.37***
	[0.39,0.48]	[0.44,0.55]	[0.37,0.47]	[0.32,0.42]
England	1.88***	1.63***	1.54***	1.28**
	[1.59,2.23]	[1.35,1.96]	[1.24,1.91]	[1.02,1.61]
Top Views	0.81***	0.76***	0.82***	0.80***
	[0.73,0.89]	[0.69,0.84]	[0.73,0.91]	[0.71,0.90]
Match Length	1.02***	1.02***	1.00	1.00
	[1.01,1.04]	[1.01,1.04]	[0.98,1.02]	[0.98,1.02]
Bet on Match	1.99***	1.70***	1.43***	1.31***
	[1.80,2.21]	[1.51,1.90]	[1.27,1.62]	[1.16,1.49]
Follow Match	1.00	0.99	1.00	1.02
	[0.93,1.07]	[0.91,1.06]	[0.92,1.09]	[0.93,1.11]
Diff in FIFA Ranking	1.00	1.00	1.01***	1.01**
	[1.00,1.01]	[1.00,1.00]	[1.00,1.01]	[1.00,1.01]
Observations	16656	16320	15936	15792

*Note: Key explanatory variable is a count of the number of television gambling advertisements present during the specified window; Coefficients are Odds Ratios (OR) showing changes in the probability of placing a football bet 'during the game'; Confidence Intervals in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01*

Additional adverts in the 60-minute window were not associated with the probability of placing a bet during the game (Table 17). An additional advert in the 30-minute window was associated with a statistically significant increase in the probability of placing a bet; participants were 1.2 times more likely to place a football bet [OR: 1·20,p<0.01]. The coefficient for the 15-minute window remained negative, and that for the 10-minute window was not statistically significant.

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Table 18: Logistic regression model using a binary variable equal to one if there is at least one gambling advertisement present during the specified window as the main explanatory variable

	Logit 60	Logit 30	Logit 15	Logit 10
Gambling Advert	**1.22*** **	**1.26*** **	**1.34*** **	**1.21*** **
	[1.13,1.32]	**[1.15,1.37]**	**[1.21,1.47]**	**[1.08,1.35]**
Watch	1.14**	1.10	1.12*	1.14*
	[1.02,1.26]	[0.98,1.24]	[0.98,1.27]	[1.00,1.30]
Weekend	0.97	0.96	0.95	0.98
	[0.88,1.07]	[0.86,1.07]	[0.84,1.07]	[0.87,1.11]
Evening	0.44***	0.48***	0.42***	0.37***
	[0.40,0.49]	[0.43,0.54]	[0.37,0.47]	[0.32,0.42]
England	1.90***	1.70***	1.52***	1.21*
	[1.61,2.25]	[1.41,2.04]	[1.23,1.87]	[0.97,1.52]
Top Views	0.80***	0.77***	0.82***	0.80***
	[0.73,0.88]	[0.70,0.86]	[0.73,0.92]	[0.71,0.89]
Match Length	1.02***	1.01*	1.00	1.00
	[1.01,1.03]	[1.00,1.03]	[0.99,1.02]	[0.99,1.02]
Bet on Match	1.99***	1.70***	1.43***	1.31***
	[1.79,2.20]	[1.52,1.91]	[1.26,1.62]	[1.15,1.49]
Follow Match	1.00	0.99	1.00	1.01
	[0.93,1.07]	[0.91,1.07]	[0.92,1.09]	[0.93,1.10]
Diff in FIFA Ranking	1.00	1.00	1.00**	1.00*
	[1.00,1.01]	[1.00,1.01]	[1.00,1.01]	[1.00,1.01]
Observations	16656	16320	15936	15792

*Note: Key explanatory variable is a binary variable equal to 1 if there is at least one television gambling advertisement present during the specified window; Coefficients are Odds Ratios (OR) showing changes in the probability of placing a football bet 'during the game'; Confidence intervals in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01*

When there was at least one gambling advert present in the specified window participants were significantly more likely to place a football bet during the game (Table 18). They were between 1.21 and 2.34 times more likely to place a football bet [OR: 1·21 – 1·34,p<0.01], with the 15-minute window exhibiting the largest effect.

5.3.9 Supplementary Analysis

All supplementary analysis is reported in Appendix 3.3 Tables 1 to 6.

5.3.9.1 Testing for Differences Between Exposure Windows

Appendix 3.3 Table 1 presents the results of formal statistical tests comparing the magnitude of effect across different exposure windows around the live games. The first column displays the results of a statistical test with the null hypothesis that exposure effects are equal across all windows, with the remaining tests looking at the equality of effect sizes between two specific windows (60-minute compared to 30-minute, 30-

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minute compared to 15-minute, and 15-minute compared to 10-minute). All p-values exceed standard threshold levels of statistical significance (5%), indicating no statistically significant difference in the magnitude of advertising effect between windows. This suggests a constant effect of advertising across all windows.

5.3.9.2 Safer Gambling Advertisements

All ITV games featured at least one safer gambling advertisement, with a maximum of two per-game. However, only four games included more two of this type advertisement, and therefore there was limited range in this variable. These advertisements were a combination of charity-based (e.g. GambleAware) and operator-branded advertisements.

In the supplementary analysis, these safer gambling advertisements were not counted as 'gambling advertisements' in the model and were instead counted as 'other advertisements' to test whether this impacted effect sizes. When removing them from the gambling advertisements variable, the coefficients were broadly unchanged or decreased (Appendix 3.3 Table 2). This was the case for all except 30-minute window where the coefficient increased marginally (by 0.01). In other words, excluding these types of advertisements from the model appears to be associated with no impact on gambling behaviour, or slight decreases in behaviour. Results excluding safer gambling advertisements are reported in Appendix 3.3 Table 2.

In further supplementary analysis, safer gambling advertisements were not counted as 'gambling advertisements' in the model but were included as their own separate regressor to test whether they independently impacted the outcome variable, gambling behaviour. This yielded no statistically significant results, and therefore these models have not been reported.

5.3.9.3 Subgroup Analysis

The subgroup analysis results are presented in Appendix 3.3 Table 3. For income group, models show the largest statistically significant effects within the £40,000 to £59,999 group. Effect sizes tend to be higher among those reporting better mental health compared to those reporting fair or poor mental health, although the differences are generally modest, especially within the narrower windows around the game. Participants classified as no, or low risk of gambling harm (PGSI score < 3) also exhibit

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greater effects. Finally, individuals over the age of 30 report larger effects compared to those aged 30 and under, except within the narrower windows (10 and 15 minutes) where this trend reverses.

5.3.9.4 Threshold Models

Threshold effects of advertising were identified in the 60-minute model (at 5 advertisements) and 30-minute model (at 4 advertisements) (see Appendix 3.3 Table 4). The 60-minute window in particular exhibits very large effects. However, this may be attributable to the nature of the advertising data, which does not have a smooth continuous distribution, but rather displays discrete jumps with clustering around specific values. In the case of the 60-minute model, most games feature 5 or 6 advertisements. The 10-minute window includes a maximum of 1 advertisement. Therefore, threshold models may not be most useful for this data, but results have been reported in Appendix 3.3 Table 4 for reference.

5.3.9.5 Additional supplementary models

Restricting the dose-response models to ITV games reduces the magnitude of effect for the 30-minute window, and this result is no longer statistically significant (Appendix 3.3 Table 5). Conversely, restricting the main causal ITV models to those who report watching the games only does not change the results (Appendix 3.3 Table 6).

5.3.9.6 Focus Group

Seven people attended the focus group on 13th December. Participants provided positive feedback on the study. They reported that it was easy to follow, mostly because it was something they were already doing (i.e. betting). They felt that the tracking their betting did not influence their behaviour but might have made them more aware of how much they were spending and would lead them to consider cutting back in the future. Participants generally found it easy to recall bets, with some referring to taking screenshots of their bets, or copying directly from apps as requested. A small number of people reported rounded the timings of their bets (n=2): usually to the nearest 5 minutes. Participants seemed to be willing to provide more information such as bet stake, odds, or whether the bet was part of a promotional offer (i.e. free bet).

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5.4 Discussion

This study explored the impact of television gambling advertising on football betting in a high-risk population group in England during the group stages of the 2022 Qatar FIFA World Cup. It used a pseudo-randomised quasi-experiment to better establish causality in a real-world betting context. Results indicate that gambling advertising significantly increased the probability, and frequency of football betting during a live game across multiple windows around the live game for a high-risk population group: men aged between 18 and 45. Exploratory work highlighted a potential dose-response effect in the 30-minute window. These exploratory results must be treated with caution due to the potential for endogeneity but are worth further investigation in future studies. The presence of at least one gambling advert was associated with significant increases in betting behaviour across multiple windows around the game. These results support the conclusions of existing reviews which report a positive effect of advertising on gambling behaviour (see Chapter Three; Bouguettaya *et al.*, 2020; Killick and Griffiths, 2022; McGrane *et al.*, 2023).

5.5 Strengths and Limitations:

5.5.5 Strengths

Study design

This is the first study to use a quasi-experimental design in an attempt to better measure the causal impact of television advertising on betting behaviour amongst a group of individuals who are at higher risk of gambling harm. It is also one of few studies to employ such methods to explore the impact of advertising on health-related behaviour in a real-world setting. The results of the study are in line with the rest of the literature, including both observational and controlled experimental studies. Its primary strength is its use of a convincing proxy variable which exploited a real-world variation in advertising exposure on gambling behaviour.

The design is further strengthened given that gambling is illegal in Qatar, so pitch-side advertising is not permitted and is therefore eliminated as a confounder. One pitch-side sponsor was identified during one recording, but the impact of this was anticipated to be low. Despite this, the impact of other types of advertising (e.g. online, social media,

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direct) should not impact the model. Other advertising between broadcasters should be the same on average, given that the average characteristics of live matches were similar. Therefore, the effects identified are most likely to be as a direct result of the variation in television advertising between ITV and BBC.

While gambling companies may compensate for the inability to advertise on TV during BBC games by increasing their use of other advertising channels - such as social media or direct marketing - the risk of this type of substitution is anticipated to be low. This is because different forms of advertising serve distinct purposes - television advertising is primarily used to reach a broad audience, whereas direct and online advertising is typically more personalised and targeted to the individual. It is more likely that operators would shift their television advertising efforts to the end of ITV broadcasts scheduled before BBC games, to compensate for the loss of TV advertising opportunities during BBC coverage.

Given the above, the findings of this study are therefore more ecologically valid. The study measured real-world betting behaviour, asking participants to copy information directly across from their accounts. The setup of the study meant that participants were only recalling up to 48 hours prior, thus reducing recall bias.

5.5.6 Limitations

Generalisability of the findings is limited due to the purposive sampling methods. This is a sample of males, in a specific age range, in England, who gamble more frequently. The use of a panel to recruit participants may introduce bias. For example, the sample has a higher employment rate compared to the general population of males (Table 11) (Office for National Statistics (ONS), 2024). Furthermore, we cannot generalise these results to women who may have a different behavioural response to advertising. Despite this, justification has been provided as to why this sample was selected. Whilst focusing on a representative population would be more in line with Rose's paradigm (Rose, 1985), which argues that focusing on the highest-risk individuals has its limitations, the sampling method ensured that each PGSI group (including non-problem gamblers) were represented in the sample. Nonetheless, further work in this area should recruit both male and female participants to establish if the findings reported here generalise to female gamblers.

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Like Chapter Four, the choice to use focus groups compared to individual interviews may have impacted participation rates and limited diversity of opinion if people felt pressured to respond in a certain way.

This study recorded football betting, and looked at television advertising only, and so it cannot be generalised to other forms of gambling advertising and betting. This is also policy relevant given the global concern about gambling advertising around sports (Bunn *et al.*, 2019; McGee, 2020; Health, 2021; Sharman, 2022; Wardle *et al.*, 2024), and the more general lack of evidence for an effect of television advertising on behaviour. Also, this is an important area given that the proximity between seeing an advertisement and the opportunity to bet on a match is much smaller and means that the effect of advertising is likely greater in this context.

There is a risk of recall and measurement bias given that the survey data is self-reported on the day following the match. As mentioned above, attempts to minimise bias included instructing participants to copy their betting information directly from their betting apps and asking them to recall over no more than 48 hours. However, the focus group identified concerns over the match-watching variable, specifically regarding measurement error (i.e. people interpreted the question differently) and endogeneity (i.e. the correlation between the choosing to watch a match and betting).

The statistical models used do not allow for a comparison of the effects between people by their sociodemographic or gambling characteristics. Observational studies suggest that the impact of advertising might be more pronounced amongst higher-risk gamblers. Future research could explore these impacts using similar methods, with participants across a wider range of PGSI scores.

It is important to reiterate that the exploratory models may suffer from endogeneity since gambling companies will be more likely to place a higher number of advertisements around games where they might expect increased betting, such as England games. However, the underlying causal pathway in the ITV model does not suffer from such issues since the operator has no choice over whether they can advertise around that game: it has been externally assigned by the broadcaster. Using multiple methods of recording advertisements might have strengthened the exploratory work by minimising

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the risk of measurement bias. Other studies have highlighted the difference in advertising between different recording methods (Sharman *et al.*, 2023). Local recordings could have supplemented the BoB recordings. However, this was judged to be too difficult given that I did not have any recording equipment, and all screen recording equipment for the computer was subject to a block on ITV which prohibited the recording of the visuals on the screen (i.e. the adverts). This is not a significant issue for the current study, since this analysis was designed to provide additional insight into the main findings, rather than to better establish causality.

Whilst matches were similar in terms of their characteristics across broadcasters, future research might compare identical football games televised on ITV and BBC at the same time to completely eliminate potential differences in match characteristics. It should be noted that comparing across the same game would require comparing across different individuals, which brings its own limitations and would require its own statistical and methodological adjustments.

The results were not changed when restricting the sample to those who reported watching the game. However, concerns remain regarding the selection and measurement bias potentially associated with this variable. The decision to watch sports is likely confounded by existing gambling behaviour, making it difficult to isolate exposure effects. Furthermore, participants were not asked when they began watching the broadcast. For these reasons, this variable is not used to restrict the primary models in this chapter. While the measure could have been improved, such as by capturing the exact timing of viewing the games, it would still be subject to selection bias, a common limitation in this type of research. Unlike a controlled experiment, this study was not able to directly control for exposure to gambling advertising on television and therefore used ITV as a proxy variable instead. However, this proxy has proven to be a strong proxy variable for advertising, and the results from this study are similar to those of other studies which use a controlled experimental setup to explore the impact of advertising exposure on gambling behaviour. Additionally, the models controlled for whether participants self-reported watching the game, despite concerns over the use of this variable.

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5.5.7 Policy Implications

The consistent, robust, positive coefficients on the frequency, and probability of betting on football during live games shown on ITV indicate that television gambling advertising is influencing football betting behaviour in the moment amongst adult male bettors in England. For the UK specifically, this indicates that current industry policies might not be sufficient to mitigate harms amongst this higher risk group. Exploratory results suggest that the 30-minute window around a game might be an important window where there is a dose-response effect in this specific population. Likewise, the 15-minute window might be a crucial point where the presence of an advert alone has a larger impact on behaviour. However, the results from the ITV models, which are methodologically more robust, indicate no significant difference in the magnitude of advertising effect between windows of exposure which suggest that advertising exposure may have a constant effect.

Exploratory results suggest that safer gambling adverts may not be mitigating the impact of other gambling adverts for this group of individuals and might be increasing their effects in some windows. Similar results using different methods and sampling have been reported (Newall, Weiss-Cohen, *et al.*, 2022). Furthermore, systematic reviews have suggested that industry-led safer gambling messaging is not effective, and independent public health messaging may better at reducing harm (Ray *et al.*, 2024).

There is preliminary evidence for the total consumption theory for gambling; increases in the average level of gambling in a population is associated with increases in gambling harm within that population (Kesaite, Wardle and Rossow, 2023). This contradicts the argument that it is only the highest-risk gambling participation (i.e. dependence) that causes gambling harm and indicates that increased frequency of gambling at a population level may cause harm. The results of the current study suggest that gambling advertising on television may be exacerbating gambling harms amongst this higher-risk group of individuals, by increasing their overall frequency of football betting, rather than simply moving market share between gambling companies. An increase in harm amongst this group of people, who are already at higher risk of harm, would likely lead to an increase in gambling harm at a population level.

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Current industry restrictions on advertising have reduced advertising around live football programmes during the restricted period only (See chapter seven; McGrane *et al.*, 2024). However, as supported by this study, advertising is still prevalent around live match programmes. There is no evidence to suggest that the pre or post-match sections are a 'safe' period where advertising can be present but harm can still be mitigated. The results of this study would indicate that current restrictions are not sufficient to counteract an increase in betting amongst this population of bettors. This raises concerns about the efficacy of existing advertising restrictions and their true ability to reduce harm amongst higher-risk population groups. See a further discussion of this in chapters seven and eight.

Results indicate that an extreme case of restricting advertising to zero (BBC) could reduce the frequency of football bets placed during a live game by anywhere between 16% and 24% for this higher-risk population group (Table 13). However, these findings should be interpreted with caution due to the exploratory nature of the analyses, the non-continuous structure of the advertising data, and inconsistencies observed across both the primary and supplementary models. Notably, only the 30-minute exposure window yielded a statistically significant positive effect in the main models. The elasticities across other windows around the live game are not consistent, potentially due to endogeneity biases described in this chapter. However, it might also be due to diminishing returns to advertising; the marginal impact of advertising might decrease as exposure increases. This could explain the inconsistent results in the exploratory models. The 30-minute window might represent the window where people are most likely to be exposed to an advertisement, and therefore the dose-response effect is captured. However, this requires further investigation.

The results from the subgroup analyses suggest that better mental health, middle-to-high income, and less risky gambling behaviour may be associated with greater behavioural response in this study. The latter finding contrasts some of the results found in the studies in Chapter Three of this thesis, but when viewed through the lens of Rose's Paradigm, imply that policies targeting lower-risk subgroups may yield greater population-level effects. It is also possible that higher risk gamblers are more responsive to different types of advertising, such as direct forms, compared to TV advertising, which

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is designed to reach a broad, general audience. Furthermore, the observation that younger people tend to display stronger behavioural responses to advertising when the window around the game narrows aligns with existing research indicating that younger people might be more likely to place in-play bets (Viera et al., 2023). Nonetheless, these are all preliminary findings that require further investigation. These results must also be interpreted with caution due to the small sample sizes in some subgroups.

5.6 Chapter Conclusion

This chapter reports the first study exploring the impact of television gambling advertising on the betting behaviour of a higher-risk population group using a pseudo-randomised quasi-experimental design. Results indicate that gambling advertising significantly increased the probability, and frequency of betting on football for this group of individuals, across various windows around the live game. A policy which restricts television advertising of gambling around live football might be an effective part of a wider public health strategy to tackle gambling-related harms amongst higher-risk groups. Future studies could replicate this design, potentially using larger, more generalisable samples, or identical games televised with, and without, advertising at the same time such as the English Football Association (FA) cup, or football World Cup, finals, to inform policy. The following chapter describes an attempt to address some of the limitations of this chapter using a more controlled experimental design.

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Chapter Six: A pilot study exploring the impact of gambling advertising on gambling behaviour amongst students at the University of Sheffield

6.1 Chapter Overview

This chapter describes a pilot study testing the effects of television advertising on gambling behaviour where the researcher can directly observe individual exposure to advertising. Due to practical and recruitment issues, no results are reported. Instead, the pilot study's strengths, weaknesses and future recommendations are specified.

6.2 Research Questions & Aims:

The aim of this study was to test whether it was possible to recruit and collect data from a sample of individuals at licensed venues showing the same live football game on broadcasters with varying gambling advertising (ITV and BBC). It used the same type of natural experiment as before but attempted to improve the internal validity of findings by directly observing exposure to advertising around live football games. A secondary aim was to descriptively analyse the survey data to see if there were differences in betting behaviour between the treated (ITV) and control (BBC) groups.

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The research questions were:

RQ1) Is it feasible to undertake an observational study at licensed venues at the University of Sheffield to explore the impact of gambling advertising on gambling behaviour?

RQ2) Is there a difference in betting behaviour between male students who are exposed to the same football match live on ITV (gambling advertising) versus BBC (no gambling advertising)?

6.3 Methods

6.3.1 Rationale

Chapter Five (World Cup study) described a quasi-experiment measuring the impact of gambling advertising on gambling behaviour during a real-world global sporting event. Despite its strengths, there are two limitations of this methodology which are worth considering:

The lack of direct control over individual exposure

Experimental studies, whilst lacking contextual factors that may be important for betting behaviour, are able to directly control for exposure to advertising. This improves the internal validity of study findings. The quasi-experimental setup in the World Cup study improves the external validity of findings by finding an external source of variation in advertising (TV channel) that is unrelated to the outcome variable (betting behaviour). However, the study does not have direct control over individual exposure, and instead looks at differences in overall betting between the two broadcasters.

Comparison of betting across different football games

Whilst the study controlled for match-level confounding variables and focussed on the group stage games to minimise differences in game excitement, it explored differences in betting between different sets of football games. It might be useful to examine differences in betting between the same game televised by both broadcasters at the same time. This would ensure the characteristics of games are identical between exposed and unexposed groups.

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These limitations highlight strengths and limitations related to the choice of methods. However, it may be possible to re-design the study to test whether its findings can be replicated using a different study design which directly addresses the main limitations.

This chapter uses a real-world sporting event, the 2023 English FA Cup, to explore differences in betting across two broadcasters televising the same live football game at the same time. A pilot study, rather than a more general feasibility study, was planned because the aim was to pilot a specific protocol for a larger study rather than to explore potential methods (Eldridge *et al.*, 2016; The National Institute for Health and Care Research (NIHR), 2021). Due to practical and recruitment issues there are no results reported. A key practical limitation was that venues refused to provide space for specific research purposes since they expected large crowds of people on that day. The original aim was to obtain this space, randomise participants to different venues with different level of gambling advertising (exposed and unexposed), and measure their real-time betting. Instead, venues agreed to allow recruitment at the venues on the day of the game. Ultimately, a number of other factors impacted recruitment on the day which will be reviewed in detail in the discussion section of this chapter.

6.3.2 Setup

Two licensed venues at the University of Sheffield (The Edge and Bar One) agreed to play the English FA cup final on 3rd June 2023 on different broadcasters. One venue played the live game on ITV (Bar One), where advertisements were present, and the other on BBC (The Edge), where advertisements were not present. This imitated a controlled experimental study where the researcher is able to assign individuals to different 'rooms' showing identical football games but can manipulate advertising exposure. Such studies have been undertaken on this topic before (Roderique-Davies *et al.*, 2020). In this case, the 'room' is the licensed venue, and the manipulation of advertising is via the broadcaster. This gives the study a more naturalistic setting, whilst ensuring the researcher can directly observe exposure to gambling advertising.

6.3.3 Participants

This study aimed to recruit 20-25 individuals in each licensed venue (50 total) to allow for some drop out. A sample size between 12 and 50 is recommended in the literature for pilot studies (Julious, 2005; Hertzog, 2008; Sim and Lewis, 2012; Billingham, Whitehead

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and Julious, 2013). As previously outlined, all studies involving primary data collection (Chapters Four to Six) use purposive sampling based on gambling involvement, with particular emphasis on groups identified in existing research as more vulnerable to gambling-related harm as measured using the PGSI - specifically younger men. Recruited participants were male students at the University of Sheffield. In addition to the above justification this also ensured that the treatment and control groups were as comparable as possible.

6.3.4 Design

On the day of the FA cup final 2023, participants were approached inside venues and asked if they were a student at the University of Sheffield, and if they had gambled in the last month. If they answered yes to these questions, they were asked whether they would be willing to take part in a short study on the following day for a £5 Deliveroo voucher. If they answered yes, then they were given a QR code to scan which took them to a preliminary survey. This survey asked them to respond with their university email address and which at venue they were currently watching the game. Only individuals with a university email address could be invited to the study to minimise the risk from collecting personal email addresses.

Due to recruitment issues, I was not able to collect any survey responses; this will be discussed in more detail below. However, had I been successful in collecting responses to the survey, potential participants would have been sent further information - in the form of a participant information sheet and consent form - through email on the following day. At this point, they would be able to decide whether they wished to participate. Participants were to be told that the study explores gambling behaviour as part of a PhD project, but the true aim of the study was to be concealed. If they did not wish to participate, they could ignore the email and their email address would be deleted within 48 hours of non-response. If they wished to take part, they could sign a consent form digitally through Qualtrics. Those who fully consented would be emailed a survey. They would be given 48 hours to complete this survey. The survey would ask them questions about their gambling behaviour on the match day in question.

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6.3.5 Surveys

This study planned to use identical surveys to those used in the World Cup study to make the studies comparable. The survey asked basic demographic questions such as age and ethnicity and then asked participants to fill in a gambling diary. The gambling diary comprised details of the football bets they placed on the match day in question, specifically asking for the bet detail, the exact timing of the bet (using a 24-hour clock), and the operator they used. They would be asked to go into their betting accounts to copy the information across directly to minimise recall bias. Focusing only on football betting aimed to reduce the burden on participants. Reimbursement in the form of a £5 Deliveroo voucher would be emailed to the participant within 48 hours of completion of the gambling survey.

Like Chapters Five and Six, the frequency of bets was selected as the most appropriate measure of gambling behaviour since it most likely reflects the causal mechanism through which advertising prompts behaviour, namely, the placement of an additional bet (see section 5.2.10 Dependent Variables for further detail).

6.3.6 Data Analysis

The purpose of the study was to understand whether the methods were feasible. As a result, any statistical analysis was to be exploratory. Descriptive statistical analysis would have explored the differences in football betting between treated and control groups (e.g. difference in mean betting between the participants watching on ITV versus BBC). It would also have observed how closely the bets occurred to exposure to the television gambling advertising.

6.3.7 Ethics

This project was approved by the University of Sheffield Ethics Review Procedure as administered by the Sheffield Centre for Health and Related Research (SCHARR). The ethics application number is 052117.

6.4 Results

Due to the low volume of students attending the venues on the assigned day, recruitment was not possible. Managers of both venues were expecting large crowds on this day given the popularity of the FA Cup. This did not occur for many reasons which will be discussed

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in more detail in the following section. The individuals that were approached in the venues were not planning to watch the game and had just come for a drink with friends. They also did not actively bet. Consequently, there are no results to report. Due to time constraints, it was not possible to re-attempt recruitment the following year. The following section will reflect on this study, its strengths and weaknesses, potential explanations for this outcome, and recommendations for the future.

6.5 Discussion

This chapter described a pilot study that aimed to test new methods for collecting data on advertising exposure and gambling behaviour in a real-world context. It combined experimental conditions with naturalistic settings to see if these methods were feasible for future research. Despite being unable to collect results, there were several strengths to this study.

6.5.1 Strengths and Limitations

This is the first time these methods have been applied in this area of research. Venues were willing to agree to participate in this study and show live games on different channels. It was also easy to move between venues to recruit samples due to their proximity to each other. One group of students who were approached, and were eligible for the study, showed a keen interest. Unfortunately, it was too late to recruit them given that they arrived late for the live game.

The recruitment issues faced in this study were due to its reliance on in-person recruitment. It required individuals to be present at the time of recruitment, to being interested in the study, to be eligible, and to be willing to participate. Ultimately, these conditions were not met.

6.5.2 Potential Explanations

One explanation for the inability to recruit was the weather conditions on the day. It was an unexpectedly warm day, and both venues were showing the game indoors. One of the venues (Bar One) is underground with little natural daylight. Therefore, people may have been less likely to watch the game in these venues and may have chosen to watch it at venues with outdoor viewing such as The Nursery Tavern, which is another (Sheffield Hallam University) student venue with a large beer garden. Another reason for poor

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attendance might be that the games were on free-to-watch TV. Therefore, people might be more likely to watch the games at home. Additionally, there is a general downwards trend in drinking amongst younger populations in high-income countries (Kraus *et al.*, 2018; Oldham *et al.*, 2018; Pape, Rossow and Brunborg, 2018; Vashishtha *et al.*, 2021), particularly Australia, Ireland and the United Kingdom (Dunphy *et al.*, 2024). This might make it less likely that this demographic of people would go to a pub or bar to watch a live sports game because they do not wish to drink. They may instead have opted to watch it at home with friends. Furthermore, the current study was undertaken in the final week of exams, so some students may still have had exams to finish, whilst others may have gone home for summer. In total, it was likely a combination of these factors that contributed to the recruitment issues.

6.5.3 Reflections

There are many weaknesses to this study that contributed towards its failure to recruit including the fact that it occurred on free-to-watch TV and during the exam period. However, this was required given the need for the quasi-experimental setup (BBC vs ITV). Future research could look at other sporting events, such as the men's Euros football tournament or the football World Cup, whose finals are also televised on both broadcasters. These tend to take place later in summer when students might have returned home. However, any future winter sports tournaments, like the 2022 football World Cup, would be more appropriate.

One solution may be to use the original design of the study using venues that are willing to give up space for research. This involves recruiting in advance and randomising individuals to attend specific venues. Individuals would check-in at the venue with the researcher prior to the game beginning. However, this still relies on participants showing up to the venue on the day. Also, forcing some participants to be exposed to advertising in real-time, which may impact actual betting, might be unethical. Another suggestion may be to choose venues outside of the university, where there may be larger crowds of people. Undertaking this research outside of university venues increases the risk to the researcher, especially given that they would be in public venues with non-students potentially drinking alcohol. An additional risk assessment may have to be undertaken. Public venues might also not be as co-operative with the study.

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The initial plan for this study was to rent two conference rooms in The Edge and pre-recruit students to attend and watch the game, where they would have access to the student bar as usual. Students were to be randomised to different rooms and exposed to different channels. However, this was not possible because the venues were expecting such large crowds that they could not offer up the space for research. Instead, they wanted the rooms as spillover rooms in case the main bar was too busy. So, future research could use a similar setup at a different venue which may be more willing to give up the additional space. This does not eliminate the ethical concerns mentioned above.

Overall, there are other ways to attempt this type of data collection, but they also have their limitations. The issues faced in the current study may have been unavoidable given that the venues themselves were not expecting such a low volume of people. Although it was likely the interaction of multiple factors that contributed to the overall failure to recruit, these weaknesses limit the usefulness of undertaking studies like this in the future.

6.6 Chapter Conclusion

This chapter described the planning of a pilot study which tested new methods of controlling for advertising exposure in a real-world setting to explore the relationship between gambling advertising and gambling behaviour. This was the first attempt at a study of this kind. However, despite the solutions raised, the usefulness of replicating this study in the future is limited due to the remaining risks.

This chapter concludes the first section of my thesis which explores the impact of gambling advertising on gambling behaviour. Evidence suggests that there is increased betting on football when advertising is present on television versus when it is not. In the following two chapters, I will expand on this by looking at a real-world advertising restriction around live sports. These chapters will assess the impact of the restriction on the presence of gambling advertising on UK television to inform future gambling advertising policy.

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Chapter Seven: How did the 'whistle-to-whistle' ban affect gambling advertising on TV? A live football matching study

This chapter presents the results from a quantitative analysis of secondary advertising data exploring the impact of the 'whistle-to-whistle' (W2W) ban on the presence of gambling advertising on television during live football broadcasts. The Version of Record of this manuscript has been published by Taylor and Francis and is freely available in *Addiction Research and Theory* :

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Full reference: McGrane, E., Pryce, R., Wilson, L., Field, M., & Goyder, E. (2024). How did the 'whistle-to-whistle' ban affect gambling advertising on TV? A live football matching study. *Addiction Research & Theory*, 1–9.

 This article is identical to the final submitted, and accepted, version of the study. Its subsequent Appendix is detailed in Appendix 4 of this thesis; all tables and figures in this appendix are labelled according to the pdf.

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There are four co-authors on this paper. The contributions of all authors, using the Contributor Role Taxonomy (CRediT), are detailed below:

Ellen McGrane: EMc led the conceptualisation, data curation, formal analysis, investigation, methodology, project administration, resources, software, visualisation, validation, and writing of the original draft, and reviewing and editing the draft for publication.

Elizabeth Goyder (primary supervisor): EG led the supervision, and supported the conceptualisation, investigation, methodology, project administration, resources, visualisation, writing of the original draft, and reviewing and editing the draft for publication.

Robert Pryce (secondary supervisor): RP supported the supervision, conceptualisation, data curation, formal analysis, investigation, methodology, project administration, resources, software, visualisation, writing of the original draft, and reviewing and editing the draft for publication.

Matt Field (third supervisor): MF supported the supervision, investigation, methodology, project administration, resources, visualisation, writing of the original draft, and reviewing and editing the draft for publication.

Luke Wilson: LW supported the formal analysis, methodology, writing of the original draft, and reviewing and editing the draft for publication.

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How did the 'whistle-to-whistle' ban affect gambling advertising on TV? A live football matching study

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ABSTRACT

Background: In 2019, the gambling industry introduced a voluntary partial advertising ban during live sports broadcasts in the United Kingdom known as the 'whistle-to-whistle' ban. This study explores the change in television advertising around live football games following the introduction of this ban.

Methods: Inverse Probability Weighted (IPW) matching models identified the change in the frequency of advertising associated with the implementation of restrictions in each section, and across the entire duration, of a live football game. Data on UK television schedules (Concise Media, TVSportsGuide) and gambling advertising (Nielsen Media) covered 3 months (1st September to 1st December) pre (2018), and post-ban (2019). There were 1049 live football games across the period studied: 468 in 2018 and 581 in 2019.

Results: The implementation of the ban was associated with a reduction in advertising (2.3 advertisements per-programme ($p < 0.001$, CI [−2.75, −1.84])), driven predominantly by reductions during half-time (2.18 advertisements per-programme ($p < 0.001$, CI [−2.32, −2.04])). It was associated with an increase in advertisements (0.34 advertisements per-programme ($p < 0.001$, CI [0.09,0.59])) during the pre-match section. In the post-ban period, an average of 3 (SD: 3.5) advertisements per-programme remained.

Conclusions: A voluntary partial gambling advertising ban in the UK was associated with reductions in television advertising during live football games during the restricted period. There is evidence of increased advertising in the unrestricted period due to the partial nature of the ban. Future research is needed to explore the impact of the ban on other types of advertising, and across other channels.

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Introduction

Gambling is a public health issue (Korn et al. 2003; Public Health England (PHE), 2023; The Lancet 2017; Thomas et al. 2023). Harms span financial, emotional, health, economic, employment, and criminal harms: affecting individuals, families, and wider society (Langham et al. 2016; Wardle et al. 2018). A public health approach to gambling harm acknowledges a wider range of social and environmental risk factors (Korn et al. 2003), an important one being advertising (Public Health England (PHE), 2023).

Gambling advertising is omnipresent, concentrated around sports, and often represents complex and riskier bets (Deans et al. 2016; Newall et al. 2019; Torrance et al. 2021). It influences gambling behavior, with the greatest impact seen in more vulnerable populations, such as those who are higher risk gamblers (Bouguettaya et al. 2020; Killick et al. 2022; McGrane et al. 2023). Higher exposure to advertising is associated with increased urge to gamble, intentions to gamble, actual expenditure on gambling, and unplanned gambling spend (Russell et al. 2018; Browne et al. 2019; Roderique-Davies et al. 2020; Wardle et al. 2022). Qualitative literature suggests that it may act as a trigger to those in recovery (Binde 2009; Lopez-Gonzalez et al. 2020). Television (TV) advertising is often quoted as the most common type of exposure (IPSOS Mori 2020; Dunlop and Ballantyne 2021; Syvertsen et al. 2022). Whilst evidence linking exposure to advertising and harm is mostly indirect, Public Health England (PHE) identified advertising as a 'societal' risk factor for gambling harms (Public Health England (PHE), 2023).

The 'gamblification' of sport has received particular attention in recent years (Bunn et al. 2019; Sharman et al. 2020; Ireland et al. 2021; Hing et al. 2023). Football is the most popular sports to bet on in the UK, and is the most popular sport to watch globally (Ireland et al. 2019; The Gambling Commission 2023). Advertising around live football is ubiquitous: including TV advertisements, sponsorship, and pitch-side advertising (Cassidy and Ovenden 2017; Bunn et al. 2019; Ireland et al. 2021). There have been calls to

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restrict gambling advertising around live football (The Big Step 2021), given its potential to normalize gambling and influence gambling behavior and subsequent harms (Bouguettaya et al. 2020; Killick et al. 2022; McGrane et al. 2023).

European countries, such as Belgium (Belgian Official Gazette 2023) have committed to universal gambling advertising bans. Others have announced partial measures excluding online and 'untargeted' advertising (The Government of the Netherlands 2023). News outlets have imposed widespread bans on advertising in digital and print media (Waterson 2023). In the UK, gambling regulation comes under the 2005 Gambling Act (The UK Parliament 2005). Amongst other things, this act liberalized advertising laws, allowing the TV advertising of sports betting and casino products.

In the UK, gambling advertising is predominantly self-regulated by an industry body known as the Industry Group for Responsible Gambling, who enforce a voluntary code of conduct (Industry Group for Responsible Gambling 2023). Up to 2019, these voluntary codes prohibited TV advertising of the industry described 'New Gambling Products' (NGPs) – anything except lottery and bingo – during the watershed. In the UK, the watershed runs from 5:30am to 9:00pm. The only exemption to this were sports programmes. In August 2019, the industry group introduced a voluntary 'Whistle-to-Whistle' (W2W) ban during live sports programmes. Under this partial ban, gambling advertising was not permitted to appear within five minutes of the match beginning, until 5 minutes after the match had ended. This included during breaks-in-play where gambling advertising had been previously been prevalent (Ireland et al. 2021). The ban covered all live sports, excluding horse and dog racing. It was implemented for live sports during the watershed period only, and it did not cover other forms of advertising such as radio broadcasts, pitch-side hoardings, sponsorship of teams or leagues, or social media advertising. Other non-live sports programmes, such as sports documentaries or highlights programmes, were no longer exempt from the blanket watershed ban. Similar partial advertising bans have been implemented in Australia and Ireland (The Australian Communications and Media Authority 2021; The Irish Bookmakers Association 2021).

Despite many examples of advertising policies, there is a lack of comprehensive analysis of their impact. The UK Betting and Gaming Council (BGC), an industry body for gambling companies in the UK, reported a near elimination of TV gambling advertisements during the W2W period for all live sports programmes (The Betting and Gaming Council 2021). However, little is known about how the ban impacted advertising during programme sections outside of the W2W period, and advertising around specific types of sport. Analyzing changes in advertising at a granular level gives us a better understanding of how advertising bans affect the presence of advertisements on TV. Furthermore, in 2023 the UK government published its Gambling White Paper (Department for Culture and Media and Sport 2023) which, among other things, left advertising during sports to the discretion of sports governing bodies, and the industry. Therefore, it is imperative we understand how this self-regulation impacts the presence of advertising around live sports.

This study fills the evidence gap by exploring the change in the frequency and placement of gambling advertising following the introduction of the W2W ban in the UK. It focuses on live football given the high presence of advertising around this sport. It expands on the analysis by the UK gambling industry body to include more data, explore the impact by game section(Pre-game, 5-min before, Half-time, and Post-game), as well as over the total duration of live football games using matching models to reduce confounding.

Materials and methods

Data

The W2W ban was introduced on 1st August 2019 (Industry Group for Responsible Gambling 2023). This study uses 3 months of data (1st September to 1st December) in the pre (2018) and post-ban (2019) years. To enhance comparability of the data, this study used the same time period at the beginning of the football season in the pre and post-ban period where the intensity of advertising was assumed to be similar. This also removed any potential variability in advertising due to irregular sporting events – those outside of the usual football calendar such as the World Cup.

Data were compiled from three sources: TV scheduling data (Concise Media), live kickoff times from a freely available online database (TVSportsGuide.com), and gambling advertising data (Nielsen Media). Information on the content of the three datasets is available in Appendix A, supplementary material. Kickoff data were scraped using 'Selenium' in R. A copy of the code used to scrape this data is available in Appendix B, supplementary material. Data were analyzed using STATA 17. The data covered all gambling advertising on all UK TV channels during the period studied

The datasets were restricted to live football programmes only, excluding live highlights programmes such as 'Match of the Day'. The three datasets were combined and live games were collapsed into sections using approximate categories by minute of the live programme (Table 1). For each section of the live programme, the total number of gambling advertisements was calculated.

Due to varying game length, it was not possible to record exact end times of football games. Therefore, the post-game section was combined to include the post-game 5-min W2W period, as well as post-game programming. The wider window around Section 2 (5 min before) was to allow for late starting times. Sections 3 and 5 (First and Second Half) were included as a sense check; there should be no advertisements during the game play.

Table 1. Game sections.

Section	Description	Categorisation by minute
1	Pre-game	Up to 5 min before kickoff
2	5-min before	5 min before kickoff to 12 min after kickoff.
3	First-half	12 to 44 min after kickoff.
4	Half-time	45 to 74 min after kickoff.
5	Second-half	75 to 100 min after kickoff.
6	Post-game	Greater than 100 min after kickoff.

Variables

The dependent variable was the frequency of advertisements during each section of the live football game, as well as the frequency over the total duration of the programme. The independent variable of interest was a binary variable representing the introduction of the W2W ban, equal to 1 if the year was 2019 (post-ban). Control variables included the day of the game, the channel (ITV, Sky, TNT Sports (formerly BT Sports), and other), and the time of the game. Channels categorized as 'other' included: S4C, Eurosport, and Viaplay Sports. Timings were categorized as midday (up to 12:59), early afternoon (13:00 to 16:59), early evening (17:00 to 18:59), and late evening (after 19:00).

Statistical analysis

Regression models were run for game sections 1, 2, 4, 6, (Pre-game, 5-min before, Half-time, and Post-game) and the total duration of the live game. Linear models were first run, followed by Propensity Score (PSM) and Inverse Probability Weighted (IPW) matching models to reduce confounding. The latter models matched on the control variables stated above. PSM models matched treated (2019) and untreated (2018) football games based on a score generated using a regression of treatment against the aforementioned matching characteristics. This produced a score between 0 and 1 representing the probability of a game being 'treated'. The model then matched football games which were close in propensity score, but differed in treatment. The 'caliper' indicates the total distance between the propensity scores of the matched football games; the wider the caliper, the less perfect the match. However, wider calipers can provide an appropriate approximation of a match, and can help to reduce confounding in the model. The minimum required caliper for these models was 0.4. Given that there is no agreed caliper suggested for use - research has suggested anywhere between 0.25 to 2 times the standard deviation of the logit of the propensity score (Stuart and Rubin 2008; Austin 2011) - IPW models were run for comparison. IPW matching is similar, but these models give a higher weight to treated football games (2019) that most resemble untreated football games (2018). This paper reports results from the IPW models which improve the balance of treatment and control groups to a greater extent than the linear and PSM models. Alternative model results are available in Appendix C, supplementary material.

Ethics

Ethical approval was not required because this research used secondary advertising and TV scheduling data.

Results

Descriptive

Data covered 1049 live football games: 468 in 2018 and 581 in 2019 (Table 1). The average length of live programmes was 154 min in 2018, and 151 min in 2019. Games spanned

Table 2. Descriptive statistics.

		2018		2019		Total	
Variable		*Freq*	%	*Freq*	%	*Freq*	%
Total number of matches		468	45%	581	55%	1049	100%
Total number of matches by channel							
	ITV	1	0.2%	7	1%	8	1%
	Sky	238	51%	249	43%	487	46%
	TNT	190	41%	198	34%	388	37%
	Other	39	8%	127	22%	166	16%
Total number of matches by day of the week							
	Monday	33	7%	46	8%	79	8%
	Tuesday	56	12%	56	10%	112	11%
	Wednesday	45	10%	53	9%	98	9%
	Thursday	46	10%	47	8%	93	9%
	Friday	60	13%	62	11%	122	12%
	Saturday	109	23%	128	22%	237	23%
	Sunday	119	25%	189	33%	308	29%
Total number of matches by time of day[a]							
	Midday	74	16%	114	20%	188	18%
	Early afternoon	70	15%	100	17%	170	16%
	Early evening	107	23%	126	22%	233	22%
	Late evening	217	46%	241	41%	458	44%
Total frequency of adverts		**2634**	**62**%	**1620**	**38**%	**4254**	**100**%
Total frequency of adverts by channel							
	ITV	18	1%	20	1%	38	1%
	Sky	2023	77%	1157	71%	3180	75%
	TNT Sports	580	22%	395	24%	975	23%
	Other	13	0%	48	3%	61	1%
		Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
Average adverts		5.8	5.30	2.9	3.50	4.2	4.60
Average programme length (mins)		154.90	32.70	151.60	33.10	152.9	32.70

[a]Midday (up to 12:59); Early afternoon (13:00 to 16:59); Early evening (17:00 to 18:59); Late evening (19:00 onwards).

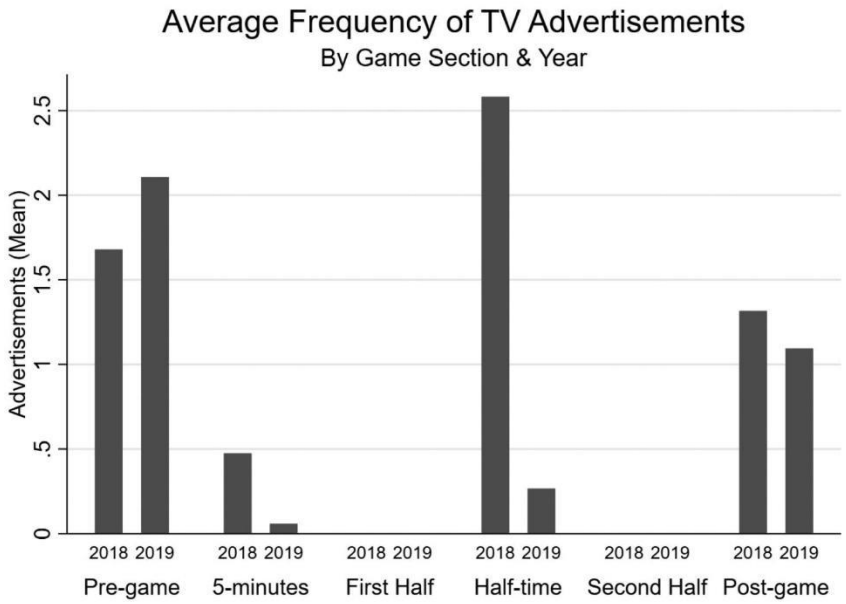

Figure 1. Average frequency of television gambling advertisements by game section and year.

across four broad categories of networks: ITV, Sky, TNT Sports, and Other. ITV is a commercial channel in the UK, whilst Sky and TNT Sports are subscription services. The majority of games occurred in the late evening, over the weekend, and on Sky or TNT Sports channels (Table 2).

There were an average of 5.8 advertisements per live football game in 2018, and 2.9 in 2019 (Table 2). A higher frequency of advertisements occurred on Sky channels. Figure 1 shows the number of advertisements by game section across the pre (2018) and post-ban (2019) years. There was a reduction in advertisements during the five minutes before the live game, and during half time section in 2019; the number of advertisements was still greater than 0 since lottery and bingo advertisements are permitted. There was an increase in advertisements in the pre-game section, and minimal change in the post-game section.

IPW models

Results

Table 3 presents the IPW matching models. There was a reduction in advertisements equal to 2.3 advertisements ($p < 0.001$; CI[−2.75, −1.84]) per live game programme following the introduction of the W2W ban. The majority of this reduction occurred during half-time: 2.18 advertisements ($p < 0.001$; CI[−2.32, −2.04]), with a comparatively smaller reduction during the 5 min before the game (Table 3). There was an increase in advertising in the pre-game section of approximately 0.34 advertisements ($p < 0.001$; CI[0.09, 0.59]) per live game programme, and no change in the post-game section.

There were fewer advertisements on Sky and TNT Sports compared to ITV during the period studied, but these result did not reach standard levels of statistical significance ($p > 0.05$). For the results of the linear and PSM models, see Appendix C, supplementary material.

Model performance

By observing the balance of covariates in the IPW model we can measure model performance. When covariates are balanced, their distribution does not differ between treatment (2019) and control (2018) groups, and therefore the groups are more comparable. Therefore, we want a matching model to provide balanced covariates. To explore this further, we have presented density plots (Figures 2–4) for the final IPW model (total programme). These are based on the differences in covariates between the treated and control groups for each of the three matching variables (channel, day of the week, time of the game). All three density plots show an improvement in fit in the weighted (matched) sample compared to the raw sample, indicating that the matched model has improved the balance of covariates. We can see this by the increased overlap of both density plots, bringing them close to complete overlap in the matched models. However, there is still significant overlap in the raw data models, likely due to the selection of two comparable periods at the beginning of the football season which improved the comparability of games in the pre and post-ban period.

We can formally test for covariate balance in the IPW model using a balance test, where the null hypothesis states that the matched model is balanced. Table 4 presents covariate balance statistics for each IPW model separately. The p-values of all models are greater than standard levels of statistical significance ($p > 0.05$), so we fail to reject the null hypothesis; the matched models are all balanced. Table 4 also indicates that the number of observations between the treated and control groups have become more balanced in the matched sample, compared to the raw sample. This removes any bias that may

Table 3. Inverse probability weighted (IPW) matching model results.

	Pre-game	5-min before	Half-time	Post-game	Total Programme
Post-ban (2019)	**0.34*** **	**−0.39*** **	**−2.18*** **	**−0.01**	**−2.30*** **
	[0.09,0.59]	**[−0.44, −0.33]**	**[−2.32, −2.04]**	**[−0.22,0.20]**	**[−2.75, −1.84]**
Pre-ban (2018)	1.74***	0.45***	2.43***	1.21***	5.29***
	[1.55,1.93]	[0.40,0.50]	[2.30,2.57]	[1.05,1.37]	[4.88,5.70]
ITV (comparator)					
Sky	−1.93*	−2.03*	−2.03*	−2.03*	−2.02*
	[−3.98,0.12]	[−4.10,0.04]	[−4.11,0.05]	[−4.11,0.05]	[−4.09,0.05]
TNT Sports	−1.95*	−2.01*	−2.01*	−2.01*	−2.00*
	[−4.01,0.10]	[−4.08,0.07]	[−4.09,0.07]	[−4.09,0.07]	[−4.07,0.07]
Other	−2.27**	−0.87	−0.89	−0.89	−0.89
	[−4.39, −0.15]	[−2.97,1.22]	[−3.00,1.21]	[−3.00,1.21]	[−2.99,1.20]
Sunday (comparator)					
Monday	0.18	0.21	0.21	0.21	0.18
	[−0.53,0.88]	[−0.36,0.78]	[−0.36,0.78]	[−0.36,0.78]	[−0.39,0.75]
Tuesday	−0.18	−0.21	−0.21	−0.21	−0.23
	[−0.78,0.42]	[−0.71,0.30]	[−0.71,0.30]	[−0.71,0.30]	[−0.73,0.28]
Wednesday	−0.23	−0.06	−0.07	−0.07	−0.08
	[−0.87,0.41]	[−0.58,0.45]	[−0.58,0.45]	[−0.58,0.45]	[−0.60,0.44]
Thursday	−0.06	−0.28	−0.30	−0.30	−0.31
	[−0.70,0.58]	[−0.81,0.25]	[−0.83,0.24]	[−0.83,0.24]	[−0.84,0.23]
Friday	−0.30	−0.26	−0.23	−0.23	−0.28
	[−0.91,0.32]	[−0.76,0.25]	[−0.74,0.28]	[−0.74,0.28]	[−0.78,0.23]
Saturday	−0.07	−0.26	−0.30	−0.30	−0.28
	[−0.54,0.39]	[−0.64,0.12]	[−0.68,0.08]	[−0.68,0.08]	[−0.66,0.10]
Midday (comparator)[a]					
Early afternoon	−0.19	−0.14	−0.16	−0.16	−0.14
	[−0.78,0.40]	[−0.58,0.31]	[−0.61,0.29]	[−0.61,0.29]	[−0.59,0.31]
Early evening	−0.21	−0.22	−0.24	−0.24	−0.22
	[−0.74,0.31]	[−0.62,0.18]	[−0.64,0.17]	[−0.64,0.17]	[−0.62,0.18]
Late evening	−0.30	−0.37*	−0.40*	−0.40*	−0.35*
	[−0.86,0.25]	[−0.77,0.04]	[−0.81,0.02]	[−0.81,0.02]	[−0.76,0.06]
Constant	2.33**	2.42**	2.45**	2.45**	2.42**
	[0.24,4.42]	[0.33,4.51]	[0.35,4.54]	[0.35,4.54]	[0.33,4.51]
Observations	736	1049	1042	1042	1045

Models report unstandardized coefficients; 95% confidence intervals in brackets; [a]Midday (up to 12:59); Early afternoon (13:00 to 16:59); Early evening (17:00 to 18:59); Late evening (19:00 onwards).
*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

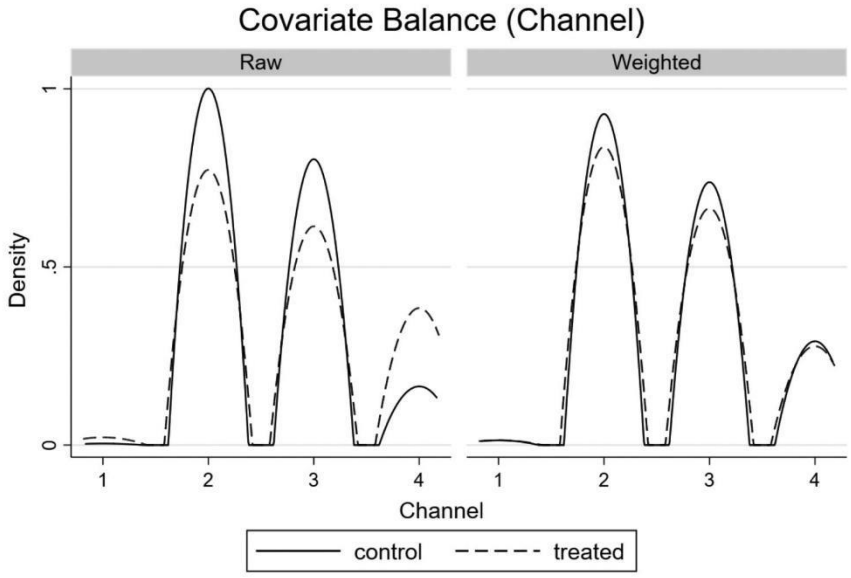

Figure 2. Density plot of covariate balance (channel the game was televised on) in the IPW models.

occur due to the increased number of games in the treated group (2019) versus the control group (2018).

Appendix D, supplementary material reports detailed covariate balance tables for both the PSM and IPW models. For covariates to be well-balanced, the matched standardized mean difference should be close to zero, and the matched variance ratios should be close to 1. These tables show that the IPW models balance the covariates marginally better

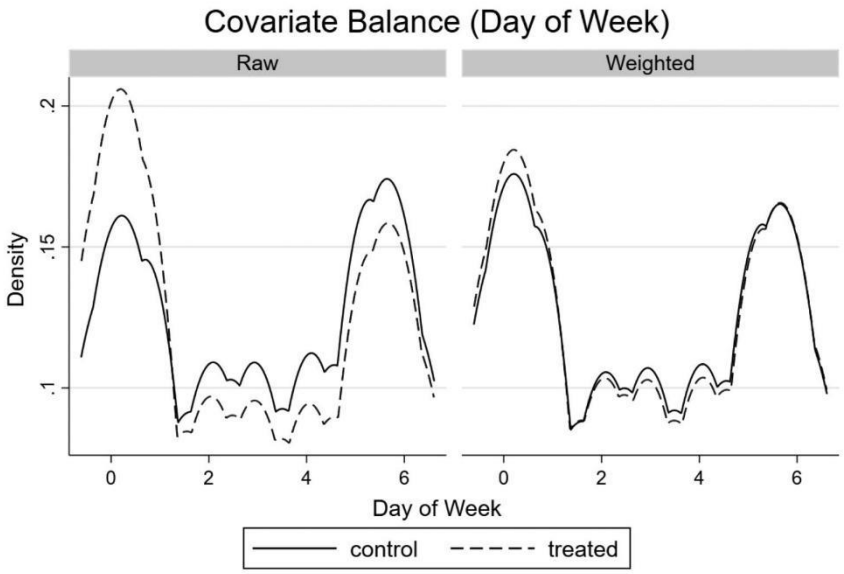

Figure 3. Density plot of covariate balance (day of the week the game was televised) in the IPW models.

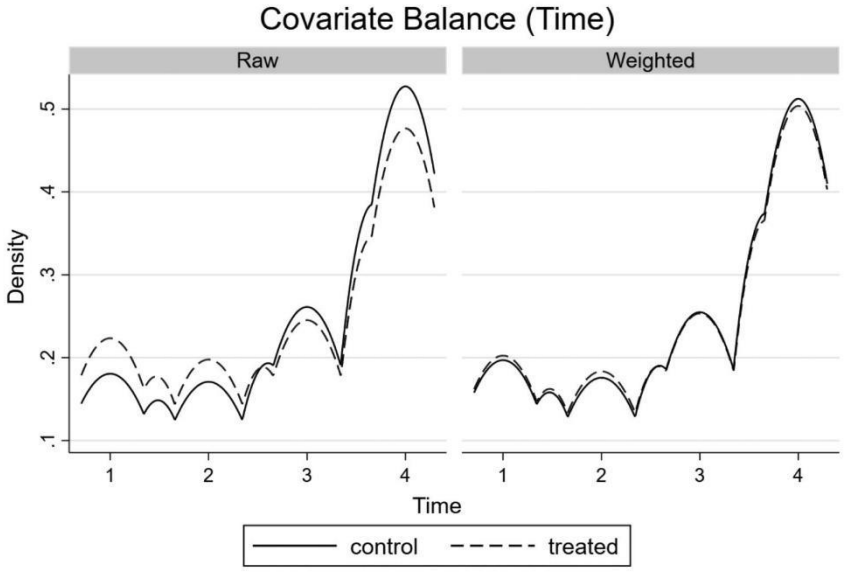

Figure 4. Density plot of covariate balance (time the game was televised) in the IPW models.

Table 4. Balance of covariates in IPW models.

	Observations[a]				
	Raw		Weighted		Balance Test[b]
	Treated	Control	Treated	Control	*p*-value
Pre-game	381	355	368.2	367.8	0.98
5-min before	581	468	527	522	0.21
Half-time	576	466	523.4	518.6	0.21
Post-game	576	466	523.4	518.6	0.21
Total programme	578	467	524.9	520.1	0.22

[a]The number of observations is the number of live games; [b]Balance test is a Chi-Squared test where H0:Covariates are balanced between treatment and control groups in the IPW model.

than the PSM models. For further information, see Appendix D, supplementary material.

Discussion

This study examined the change in the frequency and placement of gambling advertising during live televised football as a result of an industry-implemented partial advertising ban around live sports broadcasts in the UK. It found that the ban led to an overall reduction in TV advertisements

around live football games during the restricted periods (5-min before, and Half-time), with a small increase in the unrestricted pre-match section and no change in the post-match section. The comparatively smaller decreases seen during the 5 min before the game compared to half-time were likely due to the smaller time frame available for advertisements. In 2019, there remained an average of 3 gambling advertisements per live football game, attributable to the partial nature of the ban which does not apply to the pre or post-match period. Previous research has reported an average of 4.5 advertisements per game during the Men's 2020 Euro tournament, and 5.2 gambling advertisements per game during 2022 Qatar World Cup (Newall et al. 2022; Sharman et al. 2023). This is likely due to their study of large sporting events, which this study does not cover. Other research highlights a noticeable presence of gambling advertising through other forms (including pitch-side and sponsorship) during live televised football (Cassidy and Ovenden 2017; Purves et al. 2020; Rossi et al. 2023; Torrance et al. 2023), likely resulting from the exclusion of these other forms of advertising from this ban. Therefore, TV advertising restrictions may be an effective policy tool for reducing the frequency of gambling advertisements on TV around live football games. However, partial bans may be less effective in reducing the overall prevalence of advertisements on TV.

Strengths

This paper used three rich datasets on TV schedules, kickoff times, and gambling advertising to examine the impact of a voluntary advertising ban on the presence of advertising during live televised football. It goes beyond the analysis by the UK gambling industry body by looking at football specifically, over a longer period of time, and including additional data. We used matching models to reduce confounding and identify the independent effect of the ban.

Limitations

We did not have data on advertising through other channels such as direct, online, pitch-side, or sponsorship. There might be unintended consequences if the industry increased other forms of advertising to compensate for losses in TV advertising. Evidence shows that advertisements are still highly prevalent in these areas (Purves et al. 2020; Torrance et al. 2023). Advertising may also have changed across the rest of the TV network; this is an area requiring further research.

Policy implications

A voluntary partial gambling advertising ban in the UK was associated with a reduction in gambling advertising around live football games in 2019. Reductions in advertising during the 5 min before the game, and at half-time, are similar to those reported by the industry body in the UK. However, reductions over the total duration of live football may be lower than the 78% reduction reported for all live sport (The Betting and Gaming Council 2021): potentially only around 43%. An important finding is that the industry did not substitute advertisements during the restricted period for lottery and bingo advertisements, which are permitted. Results indicate that there may have been some spreading of television advertisements into the pre-match (unrestricted) section, although the magnitude of this effect is comparatively smaller.

There is no evidence to suggest that the five minutes before and after a live game is the optimal window to restrict gambling advertising. A cognitive theory known as the Serial Positioning Effect (Glanzer and Cunitz 1966) explains how people are more likely to recall items seen at the beginning and the end of list, rather than the middle. Applied to this context, it may suggest that people may be more likely to recall advertisements in the pre and post-game section, which are areas of unrestricted advertising. Whilst we are unable to comment on this in the current study, this is an area that would benefit from further research

Evidence from other industries, such as alcohol and tobacco, indicate that partial advertising bans are less effective than universal bans (Braverman and Aarø 2004; Kovic et al. 2018; Potvin Kent and Pauzé 2018; Boyland et al. 2022). There may be increases in other types of advertising, which reduce their impact. Online platforms provide an opportunity since these are highly unregulated, and have wide reach (Hastings et al. 2010; Rossi and Nairn 2022). Gamble Aware reported that the gambling industry spent 15% of their advertising budget on TV, and 10% on online advertising in 2017. Spend on social media had increased by 52% per annum between 2014 and 2017. Online marketing was reported to have increased by 23% per annum over the same period (Gamble Aware 2018). Ipsos MORI estimated TV spend to be £193,548,007, and online impressions at £8,942,818 (IPSOS Mori 2020). It is likely that online gambling advertising has modified in line with technological changes in the UK over the last seven years, although we do not have the data required to explore this.

Future research should comprehensively explore how the introduction of specific restrictions impacts overall exposure to advertising across various advertising channels. For example, it should look at how the W2W ban impacted other live sports, including those not subject to the ban (horse racing). It should also examine the entire TV network to assess whether there were changes in advertising around other TV genres, such as entertainment. The impact of the window of restriction needs further research, in addition to looking at how overall changes in advertising translate to a change in gambling behavior.

Conclusions

This study illustrates that partial restrictions on gambling advertising during televised live sports were associated with a reduction in the number of advertisements across live football games during the restricted period, and some

increases during the unrestricted period. Following the ban, advertisements remained prevalent during live football. This may impact the ability of the ban to reduce harm, since partial bans are known to be less effective. Future research must look at the wider impact of the ban, including whether there is any change in advertising during other programming post-watershed, or other forms of advertising. Evidence on the subsequent behavioral impact of the ban is also required.

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Ethical approval

Ethical approval was not required because this research used secondary advertising and TV scheduling data.

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No potential conflict of interest was reported by the author(s).

Data sharing agreement

Advertising data used in this study is not available for sharing due to licensing restrictions. However, STATA do-files and log-files are available on request from the corresponding author (EM), in addition to the scraped kickoff dataset.

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Chapter Eight: The association between the ‘whistle-to-whistle’ ban and the presence of gambling advertising on UK television

This chapter presents the second stage of analysis of the W2W ban. It explores the association between the ban and the presence of gambling advertising across the rest of the UK television network, including programmes that were not subject to the ban. The Version of Record of this manuscript has been published by Taylor and Francis and is freely available in Addiction Research and Theory:

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and accepted, version of the paper. Its subsequent Appendix is detailed in Appendix 5 of this thesis; all tables and figures in this appendix are labelled according to the pdf.

There are three co-authors on this paper. The contributions of all authors, using the Contributor Role Taxonomy (CRediT), are detailed below:

Ellen McGrane: EMc led the conceptualisation, data curation, formal analysis, investigation, methodology, project administration, resources, software, visualisation, validation, and writing of the original draft, and reviewing and editing the draft for publication.

Elizabeth Goyder (primary supervisor): EG led the supervision, and supported the conceptualisation, methodology, project administration, resources, visualisation, writing of the original draft, and reviewing and editing the draft for publication.

Robert Pryce (secondary supervisor): RP supported the supervision, conceptualisation, data curation, formal analysis, investigation, methodology, project administration, resources, software, visualisation, writing of the original draft, and reviewing and editing the draft for publication.

Matt Field (third supervisor): MF supported the supervision, conceptualisation, methodology, project administration, resources, visualisation, writing of the original draft, and reviewing and editing the draft for publication.

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RESEARCH ARTICLE

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The association between the 'whistle-to-whistle' ban and the presence of gambling advertising on UK television

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ABSTRACT

Background: A previous study explored how restrictions on gambling advertising, known as the 'whistle-to-whistle' (W2W) ban, were associated with changes in television advertising around live football broadcasts in the United Kingdom. This study explores changes around other live sports broadcasts, and other programming, in the years before and after the W2W ban.

Methods: TV scheduling (Concise Media) and gambling advertising data (Nielsen Media) between 1 September and 1 December in the pre (2018) and post-W2W ban (2019) periods were used. Linear regression models assessed changes in the frequency of advertising during sports (football, horse racing, other), and other television programming (documentaries, drama, entertainment, film, leisure, music, news, other).

Results: Results corroborate previous findings; the W2W ban was associated with a decrease in gambling advertising around live football (2.9 advertisements per-program; $p < .001$) and other live sports (0.8 advertisements per-program; $p < .001$), except horse racing where advertising increased (2.5 advertisements per-program; $p < .001$). There were small changes in advertising around other types of programming during the same years.

Conclusions: Voluntary partial gambling advertising restrictions were associated with a reduction in television advertising across all live sports, except horse racing where advertising increased. There were small changes across the rest of the UK TV network. Understanding the magnitude of reductions on gambling behavior is complex since advertisements were not eliminated post-W2W ban period. Increased advertising around live horse racing programs might also mitigate the effects. These results have implications for global gambling policy, highlighting important considerations for the overall efficacy of partial, and voluntary, advertising restrictions.

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Gambling; advertising; policy; public health; economics; sport; television

Introduction

On 1 August 2019, the gambling industry body in the United Kingdom (UK), known as the Industry Group for Responsible Gambling, agreed to a voluntary restriction on gambling advertising on television (TV). Known as the 'whistle-to-whistle' (W2W) ban, it limited the timing of gambling advertising on TV during live sports broadcasts (Industry Group for Responsible Gambling 2023). The W2W ban applies to any advertising present on TV in the 5 min before a live sports game (i.e. the first 'whistle'), to 5 min after a live sports game (i.e. the final 'whistle'). This includes TV advertising present during any half-time, or intermittent break periods. During this within-program voluntary restriction period, only lottery and bingo advertisements are permitted. Advertisements for other products, such as sports betting or casino products, are only permitted in the pre and post-game sections of programming, which lie outside of the 5-min window either side of the game. A previous study explored the association between the introduction of this voluntary W2W ban and the presence of gambling advertising during live football broadcasts (McGrane et al. 2024). Results indicated that gambling advertising reduced, and that this was mostly driven by reductions during half-time. Despite this, advertising remained prevalent in the post-W2W ban years: approximately 3 advertisements per-live program.

Aside from football, the voluntary restriction applies to all other live sport programming, excluding horse and dog racing. Other television (non-sports) genres are not subject to the W2W ban, but have been associated with a voluntary daytime restriction on TV advertising, excluding advertising for lottery and bingo products, between the hours of 5:30 am and 9:00 pm (Industry Group for Responsible Gambling 2023). At the time of the W2W ban, non-live sports programming was brought under this voluntary daytime restriction on TV advertising alongside the rest of the UK TV network. Consequently, from the 1 August 2019, only live sports programming could carry advertising for sports betting and casino products during the day, as long as it was present outside of the within-program W2W ban period.

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Evidence from other industries suggests that partial and voluntary advertising restrictions may be less effective than comprehensive restrictions (Saffer and Chaloupka 2000; Blecher 2008; Kovic et al. 2018), which are recommended by the World Health Organization (WHO) for both alcohol and tobacco (World Health Organization 2003, 2018). This is because they may cause a displacement of advertising from the restricted area toward the unrestricted area (Saffer and Chaloupka 2000; World Health Organization 2018). In this case, advertising might be displaced from live sports programming to the unrestricted period, to programming that lies outside of daytime restrictions (9:00 pm to 5:30 am), or to programming that is not subject to any restrictions (horse and dog racing). Advertising may also be substituted across different advertising media, such as pitch-side or online advertising. In order to understand the full effect of the W2W ban on TV advertising, we must explore how advertising changed across the rest of the UK TV network.

This study extends on a previous study (McGrane et al. 2024) by exploring the change in the frequency of gambling advertising across the UK TV network following the introduction of voluntary gambling advertising restrictions in the UK. It first explores the changes around live sports which are included in the W2W ban, and live sports which are exempt from the W2W ban, before exploring advertising across the rest of the UK TV network.

Materials and methods

Data

The W2W ban was implemented at the start of the 2019 football season (Industry Group for Responsible Gambling 2023). This study used three comparable months of data (1 September to 1 December) in the pre (2018) and post-W2W ban (2019) years. Choosing three months at the start of the football season was in line with when the voluntary W2W ban was introduced. Selecting these months also avoided most major global sporting events, such as the International Cricket Council (ICC) and International Federation of Association Football (FIFA) World Cups, or the Grand National (horse racing), which might have confounded results (see Appendix B for the spread of advertising across specific live sports). It was not possible to avoid all global sporting events, but choosing these dates avoided the events that were most likely to be associated with a higher prevalence of gambling advertising. For example, the Rugby World Cup took place over this period in 2019, but Rugby is a sport with a lower prevalence of gambling advertising compared to other sports (see Appendix B). The Ryder Cup (golf) took place in 2018 but over two days only. We could not look at data post-December in 2019 due to the potential influence of the COVID-19 pandemic. Therefore, we limited the data to September to December in both periods.

Data comprised TV scheduling (Concise Media), and gambling advertising data (Nielsen Media). A description of the content of these datasets is available in a previous paper (McGrane et al. 2024). After combining the datasets, data were collapsed to the program level. For each program, we calculated the total number of gambling advertisements across its entire duration. The data were pre-coded into genres, and horse racing was separated from all other sports programming before analysis:

1. Arts
2. Children
3. Films (movies)
4. Current affairs
5. Documentaries
6. Drama
7. Education
8. Entertainment
9. Leisure
10. Music
11. News
12. Religion
13. Football
14. Other sports
15. Teleshopping
16. Weather
17. Other (unassigned)

Variables

The primary dependent variable was the total frequency of advertisements during each program. A binary variable indicating the introduction of the W2W ban was the key explanatory variable in each model. This was equal to 0 if the year was 2018 (pre-W2W ban) and 1 if the year was 2019 (post-W2W ban). Control variables included the day of the game, the channel (ITV, Sky, TNT Sport (formerly BT Sport), Channel 4, Channel 5, Other) and the time of the game; Early Morning (00:00 to 4:59), Late Morning (4:59 to 11:59), Afternoon (12:00 to 16:49), Early Evening (17:00 to 20:59) and Late Evening (21:00 to 23:59). We also controlled for the length of the program in hours. These variables were selected based on available data, and their likely influence on the frequency of gambling advertising.

Statistical analysis

This study used linear regression models to investigate changes in advertising using the four control variables mentioned above. We did not use matching methods like a previous study (McGrane et al. 2024) because these methods did not improve the balance of covariates for all models. This is likely due to the additional genres being much larger and potentially requiring supplementary matching variables, which were not available for this study. However, the results of the linear regressions were similar to those from the matching regressions, likely due to the selection of two comparable time periods in 2018 and 2019 which minimizes confounding in the model.

The most heavily advertised genres were included as regression models: sports (football, horse racing, other) and other genres (documentaries, drama, entertainment, film, leisure, music, news). Horse racing was separated from all

other sports and assessed independently since it is not subject to the W2W ban. We were not able to separate dog racing since this was not categorized as a separate subgenre. The 'other sports' genre contained 45 categories of sport (see Appendix A for a detailed list). A large proportion of advertising data was assigned to the 'Other - unassigned' category; this is a characteristic of the broadcasting data used. Given the length of time required to manually categorize this group, a separate regression model was run which treats the unassigned group as its own genre.

Robustness checks

Gambling advertising data is count data which has a large number of zeros. Therefore, using a linear model may not be appropriate because these models assume normality of the data. Furthermore, other outcome variables which take account of the length of programming may be more suitable. Additional models using advertising per-hour of programming as the outcome variable, and using Poisson (count data) models, were undertaken as robustness checks. Despite small variations in the magnitude of coefficients, the results were similar. Linear models are intuitively more appealing since they provide coefficients showing the change in advertising per-program rather than ratios which may be harder to interpret and less relevant for policy. Using advertising per-hour of programming as an outcome variable is interesting, but in order to understand the impact across the whole program these need to be multiplied by the average hours of programming for that genre. Therefore, only linear models using total advertisements per-program were reported in the main paper for ease of interpretation. See Appendix C Tables C1 to C3 for the robustness checks and a comparison of coefficients across all three models.

Results

Descriptive

Table 1 details the total frequency of advertising, and hours of programming, for each of the genres. Football, horse racing, and other sport have been separated into live and non-live programming. The greatest percentage of total gambling advertising was present on documentary (13.9%) and entertainment (15.2%) programs. For sports, 2.3% of total advertising was present around football programs and 9% around other sports. Live horse racing and live football programs carried the highest number of adverts per-hour of programming (3.01 and 1.55 respectively), and per-program (14.02 and 3.46 respectively), compared to the rest of the UK TV network. Live football programs had between 2 and 5 times as many adverts per-program in 2019 and 2018 compared to all other genres, except horse racing. See Appendix B for a summary of advertising by specific live sport.

Table 1. Summary statistics.

		Total					2018 (pre-W2W ban)					2019 (post-W2W ban)				
Genre (all)		Freq	%	Total hours	Adv/ hour	Adv/ prog	Freq	%	Total hours	Adv/ hour	Adv/ prog	Freq	%	Total hours	Adv/ hour	Adv/ prog
Arts		238	0.0%	1659	0.14	0.10	128	0.0%	845	0.15	0.10	110	0.0%	814	0.14	0.09
Children		1	0.0%	19,762	0.00	0.00	1	0.0%	11,499	0.00	0.00	0	0.0%	8262	0.00	0.00
Current affairs		1396	0.3%	4560	0.31	0.19	635	0.2%	2305	0.28	0.16	761	0.3%	2255	0.34	0.23
Documentaries		72,891	13.9%	69,247	1.05	0.83	37,971	13.6%	32,909	1.15	0.89	34,920	14.2%	36,338	0.96	0.78
Drama		47,683	9.1%	52,211	0.91	0.74	25,537	9.2%	27,579	0.93	0.71	22,146	9.0%	24,632	0.90	0.76
Education		0	0.0%	41	0.00	0.00	0	0.0%	7	0.00	0.00	0	0.0%	34	0.00	0.00
Entertainment		79,773	15.2%	104,711	0.76	0.42	44,855	16.1%	57,728	0.78	0.42	34,918	14.2%	46,982	0.74	0.41
Film (movies)		30,543	5.8%	68,993	0.44	0.76	13,580	4.9%	36,879	0.37	0.64	16,963	6.9%	32,114	0.53	0.91
Leisure		17,460	3.3%	23,552	0.74	0.57	9307	3.3%	12,214	0.76	0.59	8153	3.3%	11,337	0.72	0.55
Football																
	Live	4558	0.9%	2939	1.55	3.46	2864	1.0%	1174	2.44	5.81	1694	0.7%	1766	0.96	2.05
	Non-live	7094	1.4%	7204	0.98	0.50	3417	1.2%	3480	0.98	0.48	3677	1.5%	3723	0.99	0.53
Horse racing																
	Live	3939	0.8%	1307	3.01	14.02	1818	0.7%	653	2.78	12.99	2121	0.9%	654	3.24	15.04
	Non-live	427	0.1%	1222	0.35	0.33	331	0.1%	899	0.37	0.42	96	0.0%	323	0.30	0.19
Other sports			0.0%													
	Live	10,447	2.0%	17,222	0.61	1.07	7414	2.7%	8704	0.85	1.48	3033	1.2%	8518	0.36	0.65
	Non-live	36,722	7.0%	43,266	0.85	0.62	20,746	7.4%	20,081	1.03	0.77	15,976	6.5%	23,185	0.69	0.49
Music		11,757	2.2%	16,305	0.72	0.89	10,904	3.9%	14,194	0.77	0.97	853	0.3%	2111	0.40	0.43
News		5287	1.0%	10,595	0.50	0.22	2018	0.7%	4919	0.41	0.16	3269	1.3%	5676	0.58	0.28
Religion		85	0.0%	772	0.11	0.08	22	0.0%	334	0.07	0.05	63	0.0%	437	0.14	0.11
Teleshopping		18	0.0%	2804	0.01	0.00	17	0.0%	2359	0.01	0.00	1	0.0%	445	0.00	0.00
Weather		156	0.0%	142	1.10	0.40	49	0.0%	50	0.99	0.28	107	0.0%	92	1.16	0.50
Other (unassigned)		193,858	37.0%	337,017	0.58	0.37	97,158	34.9%	162,325	0.60	0.40	96,700	39.4%	174,693	0.55	0.34
Total		524,333	100%	785,529	0.7	1.2	278,772	100%	401,137	0.7	1.3	245,561	100%	384,392	0.7	1.2

Table 2. Regression model results for sports programs.

	Live football	Live racing	Other live sports	Non-live football	Non-live racing	Other non-live sports
Change	−2.93***	2.56***	−0.83***	0.01	−0.17**	−0.24***
2018–2019	[−3.34, −2.51]	[1.09,4.03]	[−0.94, −0.73]	[−0.02,0.04]	[−0.29, −0.04]	[−0.26, −0.22]
Program	4.30***	2.76***	0.83***	1.54***	0.17***	0.88***
Length (hours)	[4.02,4.58]	[2.34,3.19]	[0.80,0.87]	[1.50,1.58]	[0.10,0.23]	[0.87,0.90]
Channel						
ITV	C	C	C	C	C	C
	–	–	–	–	–	–
Sky	−0.18	−7.66***	−1.56***	−0.28**	−7.08***	−0.03
	[−2.14,1.78]	[−10.40, −4.92]	[−1.89, −1.23]	[−0.53, −0.04]	[−7.54, −6.62]	[−0.18,0.11]
TNT	−1.79*	–	−1.65***	−1.13***	–	−0.18**
	[−3.83,0.24]	–	[−2.03,−1.27]	[−1.38,−0.87]	–	[−0.33,−0.04]
Channel 4	–	–	−2.66***	–	–	−0.40**
	–	–	[−3.30,−2.02]	–	–	[−0.75,−0.05]
Channel 5	–	–	−2.80***	–	–	−1.17***
	–	–	[−3.65,−1.95]	–	–	[−1.40,−0.94]
Other	−0.24	–	−2.53***	−1.18***	–	−0.56***
	[−2.22,1.73]	–	[−2.86,−2.20]	[−1.50,−0.87]	–	[−0.71,−0.41]
Day of week						
Sunday	C	C	C	C	C	C
	–	–	–	–	–	–
Monday	0.08	−0.81	0.16*	0.01	0.03	−0.04*
	[−0.50,0.67]	[−3.66,2.03]	[−0.03,0.35]	[−0.05,0.07]	[−0.22,0.28]	[−0.08,0.00]
Tuesday	−0.45	1.26	0.22**	0.05*	0.04	0.05***
	[−1.04,0.14]	[−1.78,4.30]	[0.03,0.41]	[−0.00,0.11]	[−0.21,0.29]	[0.01,0.09]
Wednesday	−0.14	2.60*	0.27***	0.05*	0.12	0.06***
	[−0.77,0.48]	[−0.17,5.38]	[0.09,0.46]	[−0.01,0.11]	[−0.13,0.38]	[0.02,0.10]
Thursday	−0.12	4.16***	0.44***	0.06*	−0.02	0.10***
	[−0.76,0.53]	[1.28,7.03]	[0.25,0.62]	[−0.00,0.11]	[−0.28,0.23]	[0.06,0.14]
Friday	−0.25	2.91**	0.33***	0.02	0.31**	0.06***
	[−0.83,0.33]	[0.19,5.64]	[0.15,0.51]	[−0.03,0.08]	[0.06,0.56]	[0.02,0.10]
Saturday	−0.21	0.41	0.32***	0.10***	0.03	0.07***
	[−0.69,0.27]	[−2.09,2.91]	[0.15,0.48]	[0.03,0.16]	[−0.24,0.30]	[0.03,0.11]
Time of day						
Early	C	C	C	C	C	C
Morning	–	–	–	–	–	–
Late	−2.65***	2.14	−0.31***	−0.84***	0.39***	−0.97***
Morning	[−3.31, −1.99]	[−2.53,6.81]	[−0.46, −0.17]	[−0.88, −0.80]	[0.16,0.63]	[−1.00, −0.94]
Afternoon	−2.72***	6.98***	−0.57***	−0.88***	0.90***	−0.89***
	[−3.37, −2.06]	[2.34,11.63]	[−0.73, −0.41]	[−0.93, −0.84]	[0.56,1.25]	[−0.92, −0.86]
Early	−1.17***	5.29*	−0.27***	−0.77***	3.54***	−0.89***
Evening	[−1.82, −0.52]	[−0.95,11.52]	[−0.43, −0.10]	[−0.83, −0.72]	[2.90,4.18]	[−0.93, −0.86]
Late	0.04	−0.89	−0.42***	0.37***	0.82*	0.19***
Evening	[−0.74,0.83]	[−9.14,7.36]	[−0.60, −0.24]	[0.31,0.43]	[−0.04,1.67]	[0.16,0.23]
Constant	−2.05*	−0.47	2.15***	0.49***	6.68***	0.75***
	[−4.21,0.12]	[−5.58,4.64]	[1.78,2.52]	[0.24,0.73]	[6.12,7.23]	[0.61,0.90]
N	1319	281	9725	14,065	1305	59,709

Notes: Models report unstandardized linear coefficients using total advertising per-program as the outcome variable; 95% confidence intervals in brackets; early morning (00:00 to 4:59), late morning (4:59 to 11:59), afternoon (12:00 to 16:49), early evening (17:00 to 20:59), late evening (21:00 to 23:59); C represents the comparison category for the relevant variable; *$p < .1$, **$p < .05$, ***$p < .01$.

Linear regression models

Football

Table 2 shows the model results for sports programs split by live and non-live programming. There was a total reduction in advertising around live football (2.9 advertisements per program; $p < .001$) between 2018 and 2019 when the W2W ban was introduced. An additional hour of programming was associated with an additional 4 advertisements ($p < .001$). There were no significant difference in advertising across channels or days of the week. There were significantly fewer gambling advertisements during programs televised in the late morning, afternoon, and early evening compared to early morning.

For non-live football programming there was a marginal and statistically insignificant reduction in advertising between 2018 and 2019. An additional hour of programming was associated with an additional 1.54 advertisements ($p < .001$). There were significantly fewer advertisements televised on Sky, TNT Sports, and Other channels compared to ITV. There were significantly greater advertisements shown on Saturdays compared to Sundays, though coefficients were small. There were significantly fewer advertisements shown during in the late morning, afternoon and early evening compared to early morning. However, there were significantly more advertisements shown in the late evening compared to early morning.

Horse racing

Between 2018 and 2019 there was a total increase in advertising around live horse racing programs equal to 2.5 advertisements ($p < .001$). An additional hour of programming was associated with an additional 2.8 advertisements ($p < .001$). There were significantly fewer advertisements televised on Sky compared to ITV. There were significantly more advertisements shown on Thursdays and Fridays compared Sundays, and during the afternoon compared to early morning.

Changes for non-live racing were small and negative (0.2 advertisements per-program; $p < .05$). An additional hour of programming was associated with 0.17 more advertisements ($p < .001$). There were fewer advertisements on Sky compared to ITV. There were more advertisements present during programming on Fridays compared to Sundays, though coefficients were small. There were more advertisements present at all other times of the day compared to early morning, but results for late evening were only marginally significant ($p < .01$).

Other sports

For all other live sports programming, there was a statistically significant reduction of 0.8 advertisements per program ($p < .001$) between 2018 and 2019. An additional hour of programming was associated with 0.8 more advertisements ($p < .001$). There were fewer advertisements on all channels compared to ITV. There were more advertisements present on all days compared to Sundays, though results for Monday were only marginally significant ($p < .01$) and coefficients were small in magnitude.

Likewise, the reduction around other non-live sports programming was small, but statistically significant (0.24 advertisements per program; $p < .001$). There were 0.9 additional advertisements associated with each additional hour of programming ($p < .001$). There were significantly fewer advertisements on all channels compared to ITV, except Sky which did not reach statistical significance. There were fewer advertisements on all days, except Mondays, compared to Sundays.

Other genres

Table 3 shows the model results for all other television genres. Between 2018 and 2019, there were marginal reductions in advertising around documentary, drama, entertainment, leisure, music and other programming (0.01 to 0.33 advertisements per program; $.001 > p < .05$). Around news and film programming there were small increases in advertising (0.09 to 0.15 advertisements per program; $p < .001$).

Table 3. Regression model results for non-sports programs.

	Documentaries	Drama	Entertainment	Leisure	Music	News	Film	Other (unassigned)
Change	−0.15***	−0.07***	−0.03***	−0.03**	−0.33***	0.09***	0.15***	−0.01***
2018–2019	[−0.17,−0.14]	[−0.09,−0.05]	[−0.03,−0.02]	[−0.05,−0.00]	[−0.41,−0.24]	[0.07,0.10]	[0.12,0.18]	[−0.02,−0.01]
Program	1.31***	1.20***	1.24***	0.88***	0.79***	0.36***	0.53***	0.75***
Length (hours)	[1.28,1.34]	[1.18,1.23]	[1.23,1.25]	[0.85,0.92]	[0.77,0.81]	[0.33,0.38]	[0.51,0.55]	[0.74,0.75]
Channel								
ITV	C	C	C	C	C	C	C	C
	–	–	–	–	–	–	–	–
Sky	−0.08*	0.04**	−0.50***	−0.22***	1.70	0.15***	−1.10***	−0.94***
	[−0.16,0.00]	[0.00,0.07]	[−0.52,−0.48]	[−0.33,−0.10]	[−1.62,5.02]	[0.11,0.19]	[−1.18,−1.02]	[−1.00,−0.89]
Channel 4	−0.72***	−0.19***	−0.67***	−0.80***	0.77	−0.00	0.03	−0.66***
	[−0.81,−0.63]	[−0.26,−0.12]	[−0.69,−0.64]	[−0.91,−0.70]	[−2.56,4.11]	[−0.07,0.07]	[−0.06,0.13]	[−0.72,−0.60]
Channel 5	0.18***	0.54***	−0.52***	−0.18***	1.63	0.13***	0.23***	0.25***
	[0.09,0.26]	[0.50,0.58]	[−0.55,−0.49]	[−0.32,−0.05]	[−2.20,5.46]	[0.09,0.18]	[0.14,0.31]	[0.19,0.32]
Other	−0.07*	0.05***	−0.48***	−0.46***	1.57	0.24***	−0.23***	−0.12***
	[−0.15,0.01]	[0.01,0.08]	[−0.50,−0.46]	[−0.56,−0.36]	[−1.75,4.88]	[0.20,0.28]	[−0.30,−0.15]	[−0.18,−0.07]
Day of week								
Sunday	C	C	C	C	C	C	C	C
	–	–	–	–	–	–	–	–
Monday	−0.04***	−0.04**	0.01	−0.02	−0.06	−0.03**	0.00	−0.02***
	[−0.07,−0.02]	[−0.07,−0.01]	[−0.01,0.02]	[−0.06,0.02]	[−0.17,0.05]	[−0.05,−0.00]	[−0.05,0.05]	[−0.03,−0.01]
Tuesday	−0.02	0.01	0.05***	−0.07***	−0.08	−0.01	0.02	−0.02***
	[−0.05,0.01]	[−0.02,0.04]	[0.04,0.07]	[−0.11,−0.03]	[−0.19,0.03]	[−0.03,0.02]	[−0.02,0.07]	[−0.03,−0.01]
Wednesday	0.02	0.03	0.04***	−0.03	−0.04	−0.01	0.01	−0.01**
	[−0.01,0.05]	[−0.01,0.06]	[0.03,0.06]	[−0.07,0.01]	[−0.15,0.07]	[−0.03,0.02]	[−0.04,0.06]	[−0.02,−0.00]
Thursday	0.05***	0.08***	0.08***	0.02	−0.04	0.01	0.04	0.01**
	[0.02,0.08]	[0.05,0.11]	[0.06,0.09]	[−0.02,0.06]	[−0.15,0.07]	[−0.01,0.04]	[−0.01,0.09]	[0.00,0.02]
Friday	0.06***	0.08***	0.09***	0.00	−0.01	0.02*	0.08***	0.00
	[0.04,0.09]	[0.05,0.11]	[0.07,0.10]	[−0.04,0.04]	[−0.12,0.10]	[−0.00,0.05]	[0.03,0.13]	[−0.01,0.01]
Saturday	0.05***	0.09***	0.06***	0.00	0.05	−0.00	0.02	0.01
	[0.02,0.07]	[0.06,0.12]	[0.05,0.08]	[−0.04,0.04]	[−0.05,0.16]	[−0.02,0.02]	[−0.03,0.06]	[−0.00,0.02]
Time of day								
Early	C	C	C	C	C	C	C	C
Morning	–	–	–	–	–	–	–	–
Late	−0.36***	−0.20***	−0.14***	−0.08***	0.08*	−0.08***	−0.24***	−0.12***
Morning	[−0.38,−0.34]	[−0.22,−0.17]	[−0.15,−0.12]	[−0.11,−0.04]	[−0.01,0.17]	[−0.10,−0.06]	[−0.28,−0.20]	[−0.13,−0.11]
Afternoon	−0.09***	0.03**	−0.05***	0.11***	0.27***	−0.08***	−0.17***	−0.04***
	[−0.12,−0.07]	[0.00,0.05]	[−0.06,−0.03]	[0.07,0.14]	[0.17,0.36]	[−0.10,−0.06]	[−0.21,−0.13]	[−0.05,−0.03]
Early	−0.51***	−0.51***	−0.24***	−0.22***	0.28***	−0.09***	−0.43***	−0.11***
Evening	[−0.53,−0.48]	[−0.53,−0.48]	[−0.25,−0.23]	[−0.25,−0.18]	[0.18,0.38]	[−0.11,−0.07]	[−0.48,−0.39]	[−0.12,−0.10]
Late	0.69***	0.02	0.35***	0.76***	0.54***	0.04***	0.32***	0.19***
Evening	[0.66,0.71]	[−0.01,0.05]	[0.34,0.37]	[0.71,0.81]	[0.44,0.64]	[0.02,0.07]	[0.28,0.37]	[0.18,0.20]
Constant	0.03	−0.18***	0.24***	0.39***	−1.79	−0.12***	0.35***	0.08***
	[−0.05,0.12]	[−0.23,−0.13]	[0.21,0.26]	[0.29,0.50]	[−5.11,1.52]	[−0.17,−0.08]	[0.26,0.43]	[0.03,0.14]
N	87,630	64,740	192,217	30,683	13,205	24,088	39,971	523,774

Notes: Models report unstandardized linear coefficients using total advertising per-program as the outcome variable; 95% confidence intervals in brackets; morning (00:00 to 4:59), midday (4:59 to 11:59), afternoon (12:00 to 16:49), evening (17:00 to 20:59), late evening (21:00 to 23:59); C represents the comparison category for the relevant variable; *$p < .1$, **$p < .05$, ***$p < .01$.

Each additional hour of programming was associated with between 0.36 and 1.31 additional advertisements depending on the relevant genre ($p < .001$). Across the other control variables, the relative differences in advertising across the day of the week, time of day, and channels varied in direction, magnitude, and statistical significance.

Discussion

This study explored changes in television gambling advertising associated with the introduction of voluntary advertising restrictions on television, known as the 'whistle-to-whistle ban'. Results corroborate a previous study, showing that advertising reduced around live football broadcasts. The present study expands on these earlier findings by showing that there was a comparatively smaller reduction across all other live sports programming, except horse racing which was exempt from the restrictions. Advertising around horse racing increased in 2019 even after controlling for the duration of programming. There were minimal changes observed across all other TV programming around this time. It is important to note that TV advertising during the W2W period was not entirely eliminated. This is because lottery and bingo advertisements are still permitted during this time, since they are exempt from both the voluntary W2W ban and voluntary daytime advertising restrictions.

The coefficient and sample size on the live football models were marginally higher in this study compared to a previous study because we used different models (linear), and we did not restrict programs to those which covered the full length of a football game; the previous study relied on splitting games into sections (pre-match, W2W, half-time, post-match). The time-of-day variable was coded differently to reflect the wider range of program times in the rest of the data compared to just football programs. This was to ensure all models were comparable in this study. Nonetheless results were similar.

The decrease in advertising around most live sports programs is expected; the voluntary W2W ban was an agreement to limit the available time for TV advertising around live sports broadcasts. However, in 2019, advertising around other live sports programming was much smaller than live football (Table 1). This might be due to the large number of sports in this category, with only a few sports having a higher frequency of advertising such as Cricket, Golf, and Boxing (See Appendix B Table B1).

The minimal changes around non-sports programming is likely due to the voluntary daytime restriction on advertising faced by these programs (excluding lottery and bingo products) between the hours of 5:30 am and 9:00 pm. The small changes around non-live sports are expected given that the data from 2018 suggests sparse advertising around these programs (less than one advertisement per-program). Therefore, bringing these programs under the voluntary restrictions on advertising during daytime TV, in line with other television genres, did not have a substantial impact. Although there was the opportunity to increase advertising during unrestricted times (9:00 pm to 5:30 am), or to switch advertisements during restricted periods to exempt products (lottery and bingo), this does not appear to have happened.

Between 2018 and 2019, we observe an increase in horse racing advertising, which may indicate spreading of advertising from restricted to unrestricted programming. This holds after controlling for the length of programming, the day of the week, the channel, and the time of day the program was televised. However, we cannot confirm causality. Nonetheless, live horse racing has the greatest share of advertising around live all sports programming (36%; see Appendix C), and the highest advertisements per-program (15 advertisements; see Table 1) in 2019. Live horse racing is the only genre in this study exempt from all voluntary advertising restrictions, including the W2W ban and daytime restrictions. The much higher presence of advertising around unrestricted programming raises concerns about the efficacy of voluntary partial advertising restrictions like the W2W ban.

This study could not control for overall trends in gambling advertising. Over the last decade online gambling advertising has been growing significantly; it has been reported that there was a 56% rise in expenditure on gambling advertising by operators between 2014 and 2017, mostly driven by online and social media advertising expenditure (The National Audit Office 2020). A more recent study showed increases in advertising expenditure following the COVID-19 lockdowns in the UK (Critchlow et al. 2023). Whilst there are no more recent figures on advertising expenditure in the UK in the public domain, the increase in advertising around live horse racing programs would suggest that TV advertising is still an important type of advertising media. However, future research on trends in gambling advertising would be a valuable addition to the evidence base.

Strengths

This study used two rich datasets on TV schedules and gambling advertising to explore the wider impact of advertising restrictions on the presence of advertising on television. The data allowed us to observe the distribution of gambling advertising across different TV genres. This study expanded on a previous study, enhancing our understanding of the wider impact of advertising restrictions. It also compared a number of models to test the robustness of results.

Limitations

A key limitation of this study is that it only looked at one type of advertising. Other types of advertising, such as online and embedded (e.g. pitch-side), are not included in the W2W ban. Therefore, there is the opportunity to increase advertising efforts elsewhere to make up for losses in TV advertising. Whilst we cannot comment on this in the current study, this is an area requiring further research. A general limitation of the dataset is the large proportion of unassigned data. We explored advertising amongst this group separately, treating it as its own genre, to avoid

dropping the data. This study used linear regression models. However, selecting two comparable periods of TV programming before and after the voluntary W2W ban, which avoided global sporting events that might be highly associated with gambling advertising, helped to minimize confounding. Additionally, supplementary analysis confirmed the robustness of results. Finally, the data covered 2018 and 2019 only due to budget constraints and concern over the impact of COVID-19 on gambling advertising post-2019. However, additional data from the years before and after the voluntary W2W ban would be valuable. This would allow us to observe much longer-term trends in advertising.

Policy implications

Despite the observed reductions in advertising during live sports, these programs (particularly live football) still carry some of the highest numbers of advertisements per program, and per-hour of programming, compared to the rest of the UK TV network. This is likely due to the voluntary restrictions on daytime TV advertising between 5:30 am and 9:00 pm that is applied to all other programming. Gambling advertising around other programming is still present during the day, since all voluntary restrictions do not apply to lottery and bingo products. However, the only opportunity to advertise other products, such as sports betting and casino products, during the day is around live sports programming. It appears that this is the case for live football, and to a greater extent, live horse racing where there are an average of 15 advertisements per program in 2019. Given the evidence of the impact of advertising on gambling behavior (Bouguettaya et al. 2020; Killick and Griffiths 2022; McGrane et al. 2023), particularly around sports, the higher presence of advertising around live sports may still represent a risk factor for gambling harm. Additionally, the low frequency of advertising around other programming might suggest that the restrictions on daytime TV are more effective at reducing advertising than the partial W2W ban, and may subsequently make a greater contribution toward the mitigation of gambling harms. These results have wider implications given that other countries, such as Ireland have implemented similar restrictions (The Advertising Standards Authority for Ireland 2021). Other countries are calling for a complete ban on gambling advertising (The Parliament of Australia 2023).

Understanding the magnitude of impact of these reductions in advertising on gambling behavior is complicated. Although there is ample evidence that gambling advertising has an impact on gambling behavior (Bouguettaya et al. 2020; Killick and Griffiths 2022; McGrane et al. 2023), there is no evidence of how this impact differs based on the timing of TV advertisements. Advertisements are still present during unrestricted periods, such as the pre and post-match programming sections of live sport. Therefore, we cannot estimate the magnitude of reduction in betting behavior. This depends on how influential advertisements are when present outside of the W2W period. If they are sufficient to prompt an increase in betting, then the impact of the reduction in advertising during the W2W period may be mitigated. Also, the increase in advertising around live horse racing might reduce the overall impact on betting behavior. There is some evidence of a dose-response effect of advertising (Bouguettaya et al. 2020), whereby increased exposure increases gambling behavior. Given that advertising is not eliminated around live sports, the effect on betting behavior would likely be greater than zero. However, we do not have the data to confirm this in the current study. This is an area that requires further research.

Displacement of advertising also includes substitution to other types, and content, of advertising. Whilst we do not have information on the content of advertisements in this study, it would be interesting to explore whether this changed between 2018 and 2019. For example, exploring whether the targeted content of advertisements shifted. We must also identify how other types of advertising changed at the time of the restrictions (e.g. embedded, online, direct, sponsorship) to gauge a full picture of the impact of the partial voluntary restrictions. Obtaining additional data on TV gambling advertising and comparing this to other types of advertising media before and after the voluntary W2W ban would provide a greater understanding of the longer term trends in gambling advertising, and how expenditure on advertising has changed over the years. Gambling advertising remains mostly self-regulated in the UK, and understanding how this impacts restrictions on advertising, and subsequently the presence of advertising on TV, more comprehensively is important.

Conclusions

Voluntary partial gambling advertising restrictions were associated with a reduction in advertising across all live sports, except horse racing where there was an increase in advertising. This might indicate spreading of advertising from restricted to unrestricted programming, which could mitigate the positive effects of reduced advertising elsewhere. There were few robust changes in advertising across the rest of the TV network. Advertisements were not eliminated in the post-W2W ban period, and remained comparatively prevalent around live football and live horse racing. These results highlight important considerations when evaluating the overall efficacy of voluntary partial advertising restrictions, which has implications for global gambling policy. Future research should investigate changes to other types of advertising, such as online, following the introduction of the voluntary restrictions. Research should also use additional data from before and after the voluntary W2W ban to observe the longer-term changes in advertising.

Ethical approval

Ethical approval was not required because this research used secondary advertising and TV scheduling data.

**The first sentence of the conclusions section should be replaced with the following: 'Voluntary partial gambling advertising restrictions were associated with a reduction in advertising across all live sports subject to the ban. At the same time there was an increase in advertising around live horse racing, which was not subject to the ban.'*

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

Advertising data used in this study is not available for sharing due to licensing restrictions. However, STATA do-files and log-files are available on request from the corresponding author (EM).

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Appendices

Appendix A: List of sports in 'other sports' genre (live and non-live)

1. American football
2. Angling/fishing
3. Athletics
4. Ballet
5. Basketball
6. Boxing
7. Clay pigeon shooting
8. Composite
9. Contact sports
10. Cricket
11. Curling
12. Cycling
13. Dance
14. Darts
15. Extreme sports
16. Figure skating
17. Formula one
18. Gaelic football
19. Golf
20. Gymnastics
21. Hockey
22. Hurling
23. Ice hockey
24. Judo
25. Magazine
26. Motor racing
27. Miscellaneous
28. Netball
29. News
30. Poker
31. Powerboat racing
32. Rugby (league and union)
33. Show Jumping
34. Snooker/pool/billiards
35. Special events
36. Squash
37. Swimming/diving
38. Table tennis
39. Tennis
40. Triathlon
41. Volleyball
42. Water sports
43. Weightlifting
44. Winter sports
45. Wrestling

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Chapter Nine: Discussion

9.1 Chapter Overview

This chapter summarises the findings of this thesis and describes its novel contribution to the evidence base. It discusses the strengths and weaknesses of this thesis, and the implications of its findings for future gambling research and policy. More broadly, it reflects on my experiences during the PhD, highlighting some critical challenges in gambling research more generally.

9.2 Summary of the Thesis

This thesis examined the public health impact of gambling advertising restrictions around live televised sports broadcasts in the United Kingdom. A systematic review synthesised previous evidence in this field. Quasi-experiments were used to measure the effect of existing advertising restrictions on the presence of gambling advertising on television, and to estimate the potential influence of an advertising ban around live sports programmes on gambling behaviour amongst a high-risk population group. This chapter summarises and considers their contribution to the research area. It also discusses the strengths and limitations of this research and considers the implications for future gambling research and policy.

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9.3 Main Findings

What is the impact of sports-related gambling advertising on gambling behaviour?

Research Questions:

i. *What is the existing quantitative evidence for the impact of all types of sports-related gambling advertising on gambling behaviour?*
ii. *What is the impact of television advertising around live sports on sports betting behaviour?*

The systematic review of quantitative studies (Chapter Three) explored the impact of all types of sports-related gambling advertising on gambling behaviour. It concluded that there is evidence for advertising being associated with increased gambling behaviour across a range of advertising media, including: direct messaging (e.g. emails and texts), digital (e.g. online and social media), and a range of gambling behavioural outcomes (e.g. expenditure on gambling, and likelihood of gambling). The self-reported impact of advertising was noted to be higher amongst those who are already higher-risk gamblers according to the PGSI, and therefore at an increased risk of harm. There is also preliminary evidence for specific inducements, which reduce the risk or cost of gambling, having an impact. However, this review highlighted a lack of longitudinal and experimental evidence.

The subsequent quasi-experimental studies were therefore designed to address the specific lack of this type of empirical evidence on the impact of advertising restrictions on gambling behaviour. The first exploited the variation in gambling advertising between two television broadcasters in the UK to measure the impact of television gambling advertising on gambling behaviour during a global sporting event (the World Cup). Results indicated that, amongst a higher-risk group of men, there was a significantly higher frequency of football bets placed, and a higher probability of placing a football bet, during live games that were televised on a broadcasting channel showing gambling advertising compared to one that did not. This study was the first to use multidisciplinary

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methods from psychology and economics to better measure the causal effect of sports-related gambling advertising on gambling behaviour in a higher-risk population group.

To address the limitations inherent to the above studies, a study was designed and piloted to compare two groups watching the same football game. In this study it was intended that the researcher had direct control over exposure to advertising, by randomising participants to different exposure groups. However, this was not possible, so recruitment was planned to take place inside licensed venues at the University of Sheffield during the English FA Cup final in June 2023, exploiting the fact that the match was to be televised on two broadcasters (ITV and BBC) with different levels of gambling advertising. However, due to practical and recruitment challenges, no results were generated.

What is the impact of existing restrictions on advertising around live sport on the presence of gambling advertising on television?

Research Questions:

i. *How did television advertising around live football broadcasts change after the introduction of the 'whistle-to-whistle' ban on gambling advertising in August 2019?*
ii. *How did television advertising across the rest of the UK television network change after the introduction of the 'whistle-to-whistle' ban on gambling advertising in August 2019?*

To investigate the impact of a real-world voluntary (self-regulatory) gambling advertising restriction, known as 'the whistle-to-whistle (W2W) ban', on the presence of gambling advertising on television, quantitative analysis using an existing dataset were undertaken. They used econometric methods to analyse large secondary datasets on gambling advertising and television schedules. The initial analysis employed quasi-experimental matching methods and concluded that advertising around live football programmes reduced in the year following the W2W ban. This reduction mostly occurred during the half-time period. This implies that there was no substitution effect between restricted forms of advertising (e.g. sports betting and casino products) and unrestricted

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forms of advertising (lottery and bingo). There was a slight increase in advertising in the unrestricted pre-match section which offset the reductions in the 5-minutes just before the live game. A further analysis expanded on this by looking at how advertising changed across the rest of the television network using linear regression models. Results indicated a smaller reduction in gambling advertising across all other live sports programming, except horse racing, which experienced an increase in gambling advertising in the post-W2W ban period. This may suggest that advertising spread from restricted programming (all other live sport) to unrestricted programming (horse racing). There were few changes across the rest of the television network, suggesting no spreading of advertising to non-sports programming.

9.4 Contribution to the Evidence Base

This thesis contributes directly to the evidence on the relationship between gambling advertising and gambling behaviour, and the potential public health impact of reducing gambling advertising around live sport. It fills an evidence gap by using quasi-experimental methods to explore this relationship with application to real-world sporting events. It also contributes to our knowledge of the impact of industry self-regulation on the presence of advertising, and how the industry may respond to advertising restrictions. A primary contribution of this thesis was to develop methods and provide evidence on an under-researched area of public health. More specific contributions include:

- A multi-disciplinary approach which combines methods from psychology and economics to fill an important evidence gap in gambling advertising research: Chapters Four to Six describe a study that uses a quasi-experimental setup to measure the impact of gambling advertising on gambling behaviour amongst a high-risk population group. To my knowledge, this is the first study using this approach in sports-related gambling advertising research.
- The most comprehensive quantification of the impact of restrictions on gambling advertising on the presence of advertising on television: This thesis presents the most detailed analysis of the impact of the W2W ban on

television advertising during live football broadcasts, and across the rest of the UK television network.

- A measurement of the efficacy of real-world industry self-regulatory advertising restrictions: This thesis contributes to our understanding of the overall efficacy of partial and industry self-regulatory restrictions on gambling advertising. Specifically, it identifies that advertising is comparatively highly prevalent during live sports broadcasts despite industry supported restrictions on advertising. There also appears to be a behavioural impact despite reductions in advertising in the post-W2W ban period. There are potential spreading effects, with advertising increasing during unrestricted programming. This has application beyond the UK to places such as Ireland, who have similar restrictions (The Advertising Standards Authority for Ireland, 2021).
- A contribution to the understanding of how to collect more accurate, higher quality betting data: Individual-level gambling data is spread across various operators. Sales data for gambling, equivalent to alcohol or cigarette sales data, is not available. Therefore, gambling data is commonly collected through self-report in surveys. This thesis is the first attempt to collect screenshots of betting account data directly from individuals to verify self-reported data. It has highlighted the practical and quality limitations of collecting data in this way and has made some suggestions for future alternative methods in place of this, such as asking individuals to request their data directly from operators.
- Research that is independent from industry: This thesis contributed to the evidence base which is free from industry funding. Given the substantial involvement of industry in funding of research, which primarily focuses on the individualised solution to gambling harm (Abbott, 2020; Wardle *et al.*, 2024), this supports a wider move towards research that is free from industry influence.
- The promotion of gambling as a public health problem: This research contributes to the growing evidence base promoting gambling as a public health problem by identifying potentially effective preventative public health approaches to harm minimisation.

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9.5 Critical Concerns

The results from this thesis would suggest two critical public health concerns:

Gambling advertising around live sport is still increasing gambling behaviour

Despite the W2W ban being in place, gambling advertising on television is still increasing betting behaviour in certain, higher-risk, populations. This may be because the advertisements that are present in the pre and post-programme sections are still having an increasing effect on behaviour, which is likely given that the 10 and 15-minute windows around the live matches exhibited the greatest magnitude of effect on gambling behaviour.

Gambling advertising is still highly prevalent around live sports and may have spread to unrestricted live sports

Despite the W2W ban reducing the average number of television gambling advertisements per-live sports programme, live sports broadcasts are associated with a higher frequency of advertising compared to the rest of the UK television network; this is especially true for live football and horse racing. Live sports broadcasts are the only programmes that can televise sports betting and casino advertisements on television during the daytime (5:30am to 9:00pm). Additionally, there is evidence of advertising increasing around live sports that are not subject to the W2W ban. This potential dispersion of advertising might mitigate the positive effects of reductions in advertising elsewhere. It is important to acknowledge that the observed increase in advertising around live horse racing is unlikely to constitute a one-to-one replacement in exposure from other live sports. Rather, it may represent a strategic effort by operators to partially mitigate losses in advertising exposure resulting from reduced opportunities during other live sports. Given that horse racing attracts lower viewership compared to sports such as football (Harris Interactive, 2019), a net reduction in per-capita advertising exposure is still likely.

9.6 Reflections

The specific strengths and weaknesses of each study are described in the discussion sections of each Chapters Three to Eight of this thesis. However, there are several broader strengths and weaknesses of this thesis which are discussed below.

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9.6.1 Strengths

9.6.1.1 Developing an Original Approach to Gambling Advertising Research

The first strength is its contribution of economic methods to an area that has been previously dominated by psychology. The results of this thesis corroborate much of the existing literature thus strengthening the evidence base, and case for policy intervention. Its novel, multi-disciplinary approach contributes directly to our understanding of the relationship between television advertising and gambling behaviour, and to the impact of self-regulation by the industry. In particular, the application of quasi-experimental methods strengthens the case for causality in this context.

9.6.1.2 Learning from Feasibility Studies

The use of a feasibility study, and a pilot study, facilitated the development of methods that ensure appropriate recruitment and better collection of data. The approach minimised the risk of incomplete, inappropriate, or unsuccessful data collection that may have occurred had a full-scale study been conducted initially, especially in the case of collecting transaction data in Chapter Four and the execution of the study in Chapter Six.

9.6.1.3 Real-World Application

The application of a real-world event, and a real-world gambling advertising restrictions, make the results of this thesis more externally valid. They likely represent the true impact of a gambling advertising policy in the real world. This includes the potential industry response to gambling advertising restrictions around live sport.

9.6.2 Limitations

9.6.2.1 Data and Sampling

This thesis is limited by the lack of data available on gambling behaviour in the United Kingdom, especially at the beginning of the PhD. The thesis relied on self-reported gambling data, which may be subject to recall bias. It also relied on purposive sampling methods, which limit the generalisability of findings. Nonetheless, these were all appropriate given the context.

9.6.2.2 Inability to Directly Link to Gambling Behaviour to Gambling Harm

This thesis cannot directly link gambling behaviour to gambling harm, or health outcomes. This is partly due to a lack of standardised measures of gambling harm and a

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lack of available data. It is also because it was not a primary aim of this thesis. It may indirectly infer that advertising is still increasing gambling behaviour in a higher-risk population group, despite advertising restrictions being in place. Nonetheless, there is evidence that increases in total frequency of gambling is associated with gambling harm (Kesaite, Wardle and Rossow, 2023), so this thesis can infer from its results that advertising is contributing to overall increases in gambling harm. Future research should look to strengthen the direct association. As more data is collected over the coming years, the ability to fill these data gaps will be realised.

9.6.3 Further Reflections

9.6.3.1 Impact of this Thesis

Throughout my PhD, my work has received significant attention from policy stakeholders. Several researchers have identified the need for studies of real-world impact of advertising on gambling behaviour to strengthen the case for government intervention in advertising policy. Representatives with lived experience of gambling harm have highlighted how my work resonates with their experiences. They have expressed concern about widespread advertising in sport and how this might be contributing to gambling harms. An umbrella review on the relationship between gambling advertising and gambling behaviour, that I worked on during my thesis, has been quoted in policy documents, including the 2023 Gambling White Paper (DCMS, 2023), and was referenced in a publication of Private Eye magazine in 2023. This same review received the '*Public Health Journal Paper of the Year Award 2024'* for being the most highly cited paper in that journal in 2023. My work has also received interest from global policy stakeholders, such as those at the Australian Gambling Research Centre (AGRC) who have quoted the unpublished findings on the impact of television advertising on behaviour in their policy reports (also unpublished). The findings of this thesis have also been published as 'research snapshots' on the Gambling Research Exchange Ontario (Greo) website (Greo, 2023a, 2023b, 2024). These publications are useful for increasing visibility of academic research beyond academia, by creating a plain language summary of studies. Finally, in January 2025 I was invited to attend a parliamentary round table discussing recommendations by the Lancet Public Health Commission on

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Gambling (Wardle *et al.*, 2024), including those for gambling advertising restrictions in the UK.

9.6.3.2 Conflicts of Interest in Gambling Research

An issue I faced during this PhD was the dominance of industry in research, and how this creates complex conflicts of interest (COI). At the beginning of my PhD, the first independent UK gambling conference was initiated, *'Current Advances in Gambling Research (CAGR)'*. This was the only gambling-specific conference in the UK without industry funding that was available for me to attend. Other conferences related specifically to research in addiction had some presence of gambling research, but very little. I found it difficult to get critical feedback from these audiences, because most people were unfamiliar with the research area. In the second year of my PhD, I chose to attend a conference in Las Vegas hosted by the University of Nevada. At the time, I did not recognise the need to check the funding for conferences, and I was not aware of the substantial industry funding that this conference received. Whilst I can take some positives from this experience, including meeting with other global Public Health gambling researchers and experiencing first-hand how the industry might shift the narrative of gambling research, in hindsight, I would not have attended. This created a COI for myself, which ultimately impacted my ability to meet with other researchers in the future. In particular, one researcher in Australia refused to meet with me due to my attendance at this conference. I believe that this issue is slowly beginning to resolve itself. With the new gambling levy dedicating 20% of its funding to independent research (DCMS, 2023, 2024), potential COI should be mitigated in the future. In the interim period, it has taken time to understand how best to approach COI in gambling research, and how to avoid situations like those described above in the future.

9.6.3.3 Barriers to Accessing Data in Gambling Research

Accessing data for gambling research can be difficult. In an ideal world, this thesis would have selected a gambling advertising policy in the UK, explored how the policy impacted the presence of advertising, and then how this impacted gambling behaviour. I soon realised that there were no legislative policies in the UK, and few elsewhere, that I could analyse. As a result, I had to find a setting which imitated a gambling advertising policy instead. I also found that gambling data was not routinely collected in representative

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population health surveys in the same way as data on drinking or smoking. It was clear that primary data collection was the only way to obtain individual gambling data for this thesis. This was very costly and limited my sample.

To explore the impact of the 'Whistle-to-Whistle' (W2W) ban I had to purchase expensive datasets on gambling advertising and television schedules. I was fortunate that I had funding to purchase this data but still had to forego interesting variables such as the content of the advertisement, due to the high cost of the data. Data on live kick-off times for sports games were not available for purchase. I overcame this by scraping data from a website but acknowledge that this is not an ideal solution. I was unable to link the W2W advertising restriction to gambling data because the Health Survey for England only had this data available for the pre-W2W ban period. Detailed gambling data will become more accessible in future years with the introduction of the Gambling Survey for Great Britain in 2024. However, this survey is cross-sectional, so longitudinal analyses might still rely on primary data collection.

9.7 Implications

9.7.1 Framing the Implications of this Thesis for UK Gambling Advertising Policy

As discussed above, there is a notable absence of regularly collected data on gambling in the UK compared to other behaviours such as smoking or drinking. Individual-level data are held privately by numerous operators, while survey data collection tends to be intermittent and lacks granularity. This restricts the capacity to conduct representative and generalisable research that can directly inform UK policy. Consequently, the findings of this thesis are constrained by these limitations, specifically regarding the non-generalisable sampling in Chapters Four to Six, and the lack of behavioural and health outcomes data in Chapters Seven and Eight. Nonetheless, the evidence presented in this thesis represents some of the most robust currently available on gambling advertising and the impact of industry self-regulation.

The precautionary principle advocates for policy intervention when scientific evidence is uncertain about an environmental or human health risk, but the risk of harm is high (Martuzzi, Tickner and Europe, 2004). It implies a social responsibility to protect the

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public from harm when evidence suggests plausibility of risk. In this context, the findings of this thesis may inform policy despite the absence of a fully representative study, particularly given the methodological rigor of the causal inference approaches employed. Academics have emphasised that the absence of evidence in gambling advertising research, often due to methodological constraints, should not be conflated with absence of effect (Newall *et al.*, 2024).

9.7.2 Implications for UK Gambling Advertising Policy

The 2005 Gambling Act (The UK Parliament, 2005), which legalised television advertising for sports betting and casino products, is the basis for most gambling policy in the UK. A 2023 review of this Act (Department for Culture, Media and Sport (DCMS), 2023) recommended a consultation on cross-selling of products through direct advertising methods (e.g. emails). New rules may require individuals to opt-into being cross-sold products besides the one they have purchased. It also suggested consulting on rules around incentives, such as bonus offers and free bets (Department for Culture, Media and Sport (DCMS, 2023). This may be important given the results from Chapter Three which suggest that these may be influential types of advertising. However, the same review announced no changes to the scheduling requirements for TV advertising, which are currently set by the gambling industry (Industry Group for Responsible Gambling, 2023). The White Paper states:

"...measures like the whistle-to-whistle ban have had tangible impacts in reducing children's exposure to gambling adverts and the overall volume of broadcast ads."

The conclusions of this thesis, supported by the precautionary principle, suggest that the UK government's lack of intervention in gambling advertising policy may not be justified based on the success of self-regulation by the industry. Voluntary self-regulatory efforts do not appear to have mitigated the behavioural impact of advertising that remains around live sports on a higher-risk population group. Moreover, the partial nature of advertising restrictions may have led to an increase in advertising during unrestricted live horse racing programming. Given the reported relationship between gambling advertising and gambling behaviour, these increases in advertising might mitigate the positive impact from reduced advertising elsewhere.

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As stated in Chapter Two, and Rose's Paradigm (Rose, 1985), population-based approaches to gambling policy, such as those that restrict gambling advertising, have the potential to generate large gains from an accumulation of small individual-level gains. This is because there are a much larger number of people in the lower-risk gambling groups. Despite the non-randomised sampling approach used, the causal effects of advertising on behaviour identified in Chapter Five of this thesis, supported by the precautionary principle, would support this risk curve shifting population approach to harm minimisation. This approach would target small reductions in individual gambling in response to advertising across the population to prevent future harm by reducing the likelihood of individuals moving into a higher-risk gambling groups in the future.

9.7.3 Additional Evidence That Would Support Wider Restrictions

Public health interventions which reduce exposure to gambling advertising have been recommended for reducing gambling harms (Blank *et al.*, 2021; Regan *et al.*, 2022; Wardle *et al.*, 2024). The World Health Organisation recommends comprehensive legislative advertising restrictions for other commercial determinants of health (World Health Organisation, 2003, 2018) to eliminate the risk of spreading of advertising into unrestricted areas. The results from this thesis raise concerns around current partial self-regulatory advertising mechanisms and their ability to reduce exposure to gambling advertising, and subsequent gambling harm.

9.7.4 Global Implications

The results of this PhD have implications beyond the UK. These findings, backed by the precautionary principle, may support restricting advertising to mitigate its behavioural impact on higher risk groups, but would suggest that partial advertising bans might not be sufficient. This is directly relevant to countries that have implemented a partial W2W ban similar to the UK (The Advertising Standards Authority for Ireland, 2021). It is also relevant to other countries that have implemented restrictions (Belgian Official Gazette, 2023; The Government of the Netherlands, 2023). The efficacy of some of these policies have already been contested (Constandt and De Jans, 2024; De Jans, Hudders and Newall, 2024).

The findings would suggest that countries that are moving towards restricting gambling advertising in more comprehensive way are doing the right thing (Parliament of Australia,

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2023). Countries that are moving in the opposite direction are potentially going to see increases in gambling behaviour which might lead to increased harm. For example, in the United States of America (USA), the repeal of the Professional and Amateur Sports Protection Act in 2018 has led to significant growth in the market (Nelson *et al.*, 2019; Hollenbeck, Larsen and Proserpio, 2024), including increased spend on gambling advertising (American Gaming Association, 2024). This thesis has identified how a relaxation of advertising laws in 2005 has led to increases in advertising, and how self-regulation by the industry may not be the optimal solution. The experience of the UK should be a lesson to other jurisdictions.

9.7.5 Gambling as a Commercial Determinant of Health

At the beginning of this thesis, I described the commercial determinants of health and how gambling is often excluded from its definitions. There are various practices that the gambling industry are involved in that fit into the broad definition of CDoH. Below, I have detailed some of the relevant practices that relate directly to the findings of this thesis. The gambling industry has been able to secure self-regulation of advertising through political and scientific practices. This includes promoting evidence of the success of these regulatory mechanisms (The Betting and Gaming Council, 2021). Its widespread advertising around live sports, carve-outs for sports broadcasts in its self-regulation, and corporate social responsibility (CSR) initiatives like the W2W ban, help to promote its products whilst also promoting the reputational image of the industry and its products. The results of this thesis highlight the potential failure of self-regulation from influencing behaviour in a higher-risk population group, and ability of CSR initiatives to distract the government, and the public, from the remaining prevalence of gambling advertising around live sport, and the potential spreading of advertising which might partially mitigate positive impacts. This thesis highlights the need to frame gambling through a CDoH lens, and to learn from other areas of research such as alcohol and tobacco. These practices are not specific to the gambling industry but have been occurring across other CDoH for many years.

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9.8 Directions for Future Research

Despite the significant contributions of this thesis, there are still many important methodologies and topics of gambling research that are yet to be explored. This section highlights some directions for future gambling research identified during this PhD.

- More longitudinal and experimental studies: This area of gambling advertising research needs studies which are more able to establish causal effects to strengthen the evidence base. Studies similar to those in Chapter Five of this thesis could be repeated using larger, more representative, samples to increase the generalisability of findings. Ecological Momentary Assessment methods also offer promising solutions to self-reported data biases and for enhancing the ecological validity of findings. Future quasi-experimental studies could use representative population samples like the Health Survey for England or the Gambling Survey for Great Britain. Other experimental studies might include controlled laboratory studies that can directly manipulate exposure to advertising.
- Research on growing types of advertising media: Chapter Three identified existing research on growing forms of advertising such as digital (e.g. social media) and direct (e.g. email and text messages). This is an area requiring further research given the rapid growth of the internet in the last decade, and evidence that gambling advertising expenditure increased in 2021, especially for online casinos and mobile content (Critchlow *et al.*, 2023). Studies could use web-scraping to collect information on social media advertising (Russell *et al.*, 2023, 2023; Smith *et al.*, 2023). They could replicated methods used by Russell and colleagues (2018), where participants were asked to forward the direct emails and text communications that they received from gambling operators.
- Research on regional advertising: It would be useful to understand whether there is regional variation in advertising, and how these variations might relate to the characteristics of that region, such as the sociodemographic makeup of the area, or the level of gambling harm. Similar studies have looked at the location of gaming machines and gambling premises (Wardle *et al.*, 2014; Saunders *et al.*, 2023). This research could look at the frequency of advertisements, the brand or

product advertised, or the content of the advertisement. To my knowledge, no such research exists.

- Research into the content of advertising: Evidence on the type, and content, of gambling advertising exists (Newall *et al.*, 2019; Torrance *et al.*, 2021). However, evidence comparing how this changed before and after the introduction of the W2W ban would further add to our understanding of the overall efficacy of industry self-regulatory actions. It would be relevant to understand how the content of advertisements that remain around live sports in the post-W2W ban period have, or have not, changed.
- Research into 'video on demand' advertising: The rise in the use of 'video on demand' (VOD) television services warrants attention. These services allow the viewer to select the programme they want to watch at any time. These are different to linear broadcasting services which have a television guide with a choice of live programmes. VOD are regulated under non-broadcasting codes by the advertising authorities (The Advertising Standards Authority (ASA), 2024), though their codes are similar to the broadcasting codes. Within VOD services, there are broadcasting VOD (BVOD e.g. Channel 4, ITV) and subscription VOD (SVOD e.g. Sky, Disney). Currently, the IGRG self-regulatory codes do not mention VOD services. The results from chapters seven and eight indicate that advertising around non-sports, and non-live sports, programming is very low. It would be interesting to know whether the prevalence of advertising around these VOD services is similar. Nonetheless, it would be complex to regulate these in the same way as linear broadcast TV given that the individual has a choice over what time to view the programme. This would be an interesting concept to explore further.
- Estimating the impact of advertising policies on individuals with gambling dependence: Advertising policies might differentially impact people with gambling dependence. Despite chapter five focusing on a higher-risk group of gamblers, I was not able to separate the effects by risk-type (e.g. PGSI score). However, future studies could explore similar questions to those in chapter five amongst dependent populations.

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9.9 What is Still Needed?

Despite there being several under-researched areas in gambling research, there are some barriers to addressing these areas, primarily a lack of representative regularly collected data. Some potential solutions include:

- Regularly collected longitudinal data on gambling behaviour: This is extremely important if gambling research is to 'catch-up' with other public health research. Measures of gambling behaviour and gambling dependence (e.g. PGSI) should be included regularly in datasets such as the Health Survey for England. To date, this has been done intermittently. In 2024, the first wave of the Gambling Survey for Great Britain was released. This is one of the largest datasets on gambling behaviour in the world and provides significant opportunities for research in the future. However, neither of these datasets are longitudinal, but longitudinal data could be obtained by including relevant measures in cohort studies such as Understanding Society. These measures must be included regularly to allow us to assess changes in gambling harms over time. However, care should be taken to assess harms across the entire range of gambling behaviour, including those affected by someone else's gambling, to avoid promoting the narrative that it is just a small percentage of the population who experience hams (Wardle *et al.*, 2024).
- Improved betting data: Recent research has used banking data (Muggleton *et al.*, 2021). This offers a partial solution, but banking data does not detail wins and losses which can be important for understanding gambling behaviour (5th ed; DSM-5; APA, 2013; Markham, Young and Doran, 2016; The Gambling Commission, 2024c). Future research could look at using data on gambling-related debt or finding alternative methods of collecting individual account data from Chapter Four, such as asking participants to request their data from operators directly. This would supplement current self-reported research rather than replace it, since different measures will be required for different studies.
- Wider use of alternative methods to obtain data where there are currently gaps**:** Using web scraping methods, similar to those used in chapters

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seven and eight, may be useful for obtaining data where it is currently not available (or too expensive). These methods are useful to collate and categorise data on advertising media that is difficult to measure. For example, social media advertising data (Russell *et al.*, 2023; Smith *et al.*, 2023; Singer, Wöhr and Otterbach, 2024).

- Updated evidence on expenditure on gambling advertising by product type: Chapters seven and eight did not account for any existing trends in advertising expenditure. However, this data is not available in the public domain. Data that is available is from before 2018 (Regulus Partners, 2018) or during the COVID-19 pandemic (Critchlow *et al.*, 2023). Similar updated figures on advertising expenditure would increase our understanding of how the advertising landscape has changed over time.
- Standardised measures of health for gambling: In the longer-term, producing standardised measures of health related to gambling would increase our understanding of the impact of gambling on population health. Research has shown that generic measures of health may be inappropriate for measuring gambling harms (Moore *et al.*, 2024). However, there is some evidence for the impact of gambling on population health-related quality of life (Moayeri, 2020; Browne *et al.*, 2022; Tulloch *et al.*, 2023). Researchers have attempted to create more sensitive measures of gambling harms, such as the Short Gambling Harms Scale (SCHS) (Browne, Goodwin and Rockloff, 2018). These must also be included in regular surveys to allow monitoring people's level of harm over time. This is an area that would benefit from more research in order to bridge the gap between behavioural and harms studies, and provide evidence that governments require to implement policies.

9.10 Chapter Conclusion

This thesis explored the impact of gambling advertising restrictions on television using systematic review and econometric methods, with a particular focus on live sports. Results indicate that, despite the presence of industry-led restrictions on advertising, television gambling advertising is increasing gambling behaviour amongst a higher-risk population group. Furthermore, the partial nature of restrictions might have led to a

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spreading of advertising from restricted to unrestricted television programming. Advertising also remains comparatively highly prevalent around live sports broadcasts compared to the rest of the UK television network. This raises concern about the overall efficacy of voluntary self-regulatory approaches to gambling advertising policy in the UK. The findings of this thesis, supported by the precautionary principle, indicate that current regulatory approaches are unlikely to be sufficient to address the negative consequences of gambling advertising on gambling behaviour, and subsequent gambling harms.

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Appendices

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10.1 Appendix 1: Appendix for Chapter Three

APPENDIX A: STUDY TYPES (MMAT)

Study Type (MMAT)	**Description**
Quantitative randomised	A study in which individuals are allocated to an intervention or control group by randomisation. For the purpose of this review these are called experimental studies.
Quantitative non-randomised	Quantitative studies where the impact of an intervention or exposure (advertising) does not use randomisation to allocate treatment and control groups. For the purpose of this review these studies are combined with the above category (experimental) since the researcher assigns the exposure to participants.
Quantitative descriptive	These are concerned with describing the distribution of variables without specific regard to causal relationships. For the purpose of this review these are called observational studies, and they describe studies where the researcher does not allocate the exposure to advertising but attempts to measure it separately. The mixed-methods (n=3) studies in this review fall into this category based on their quantitative section.

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APPENDIX B: DETAILS OF SUPPLEMENTARY SEARCHES

List of Authors Searched	List of Websites Searched
• Alex Russell • Nerilee Hing • En Li • Anna Thomas • Rebecca Jenkinson • Peter Vitartas • Matthew Browne • Matthew Lamont • Elian Fink	• Gamble Aware (research library) • The Gambling Commission (statistics and research) • Gam Care (data and insight/policy and research) • National Problem Gambling Clinic • Gordon Moody Association • Gamblers Anonymous • Open Grey (DANS) • Gam-anon (publications) • Victorian Responsible Gambling Foundation (publications) • Advisory Board for Safer Gambling UK (publications) • Gambling Watch Scotland • Glasgow City Gambling Harms • Citizens Advice Bureau • Australian Gambling Research Centre (research findings) • Gambling Research Exchange Ontario (evidence centre) • International Centre for Youth Gambling Problems and High-Risk Behaviour (research and publications) • AUT Gambling & Addictions Research Centre (our research) • Alberta Gambling Research Institute (publications and statistics) • Responsible Gambling Council • Betting and Gaming Council • Problem Gambling Foundation New Zealand • Gambling Commission New Zealand • Gov.uk (research and statistics) • Department for Culture, Media and Sport (research and statistics) • Australasian Gaming Council (research and policy)

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APPENDIX C: MEASURES USED IN EACH STUDY

No.	Authors	Year	Relevant Gambling Behaviour Measure	Behaviour Type	Advertising Measure	Advertising Type
1	Houghton & Moss	2020	Immediate likelihood to bet on a visual analogue scale (0 to 100); Bet stake (£)	Likelihood of betting and amount bet	Participants exposed to fake tweets from operator and affiliate accounts in an experimental setting.	Digital
2	Noble et al.	2022	Self-reported ever gambled in the last 30 days (yes/no); types of gambling activities in the last month ('hard' types e.g. casino, card, sports games, poker machines, horse racing and 'soft' types e.g. bingo, lottery, scratch cards); Diagnostic Statistical Manual-IV adapted for Juveniles (DSM-IV-[MR]-J; revised to yes/no response)	Gambling over recall period (30 days), Gambling risk level	Adaptation of Hing et al., (2014) exposure to advertising scale (specifically the awareness of sports/celebrity ads in the previous 30 days)	Aggregate
3	Roderique-Davies et al.	2020	Immediate self-reported urge to gamble using the Gambling Urge Scale (Raylu & Oei, 2004); Problem Gambling Severity Index	Urge to gamble, Gambling risk level	Pre-recorded videos of sports games with and without embedded gambling promotions (plus a non-sports control video)	Embedded
4	Russell et al.	2019	Self-reported percentage of sports bets that the respondent placed on micro events.	Gambling over recall period (30 days)	Estimated using frequency of watching 9 major sports; Reporting how frequently they saw/heard gambling advertisements (Likert; never to almost always)	Aggregate

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5	Hing et al.	2019	Perceived influence of past 24-to-48 hour exposure to advertising and inducements on betting (Influence/No influence); How it influenced betting (bet amount, safety, risk); Problem Gambling Severity Index	Perceived influence of advertising on behaviour (24-48 hours recall), Gambling risk level	Whether advertisements were seen/heard in the previous 24 to 48 hours (Yes/No)	Traditional, Online, Direct, Embedded
6	Hing et al.	2018	Self-reported percentage of past year sports bets that were 'researched and planned in advance', 'on impulse before the start of the match' and 'on impulse during the match'; Problem Gambling Severity Index	Gambling over recall period (1 year)	How frequently they watched 9 major sports in the most recent season; How often they heard/saw advertisements (never, sometimes, most of the time, almost always).	Aggregate
7	Russell et al.	2018	Self-reported actual race and sports betting expenditure; intended race and sports betting expenditure (both over the previous 24 hours).	Gambling over recall period (24 hours), actual and intended	Total number of direct messages received; total number of emails received; total number of texts received; total number of inducements received (all self-reported over previous 24 hours in EMA survey, actual texts and emails forwarded to the researchers)	Direct, Inducements
8	Hing et al.	2017	Problem Gambling Severity Index score	Gambling risk level	Self-reported frequency of watching eight types of televised professional sport (sports where advertising is most prominent) in the most recent season (7-point Likert; never to daily); Sponsorship response	Sponsorship, Aggregate

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					scale (Speed & Thomas, 2000) for likely use of sponsors product	
9	Hing et al.	2016	Problem Gambling Severity Index score	Gambling risk level	Self-reported frequency of watching eight types of televised professional sport (sports where advertising is most prominent) in the most recent season (7-point Likert; never to daily)	Aggregate
10	Di Censo et al.	2023	Perceptions of sports betting promotions scale (likelihood of influencing them to bet, and to engage in high risk gambling behaviours)	Perceived influence of advertising on behaviour	Fake social media advertisements for a fictional betting company.	Digital, Inducements
11	Hing et al.	2015a	Self-reported perceived impact of gambling promotions on behaviour (increased frequency of sports betting, caused them to spend more money than intended on sports betting) on 5-point Likert scale (strongly agree to strongly disagree)	Perceived influence of advertising on behaviour	Self-reported frequency of watching eight types of televised professional sport (sports where advertising is most prominent) in the most recent season (7-point Likert; never to daily)	Embedded

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12	Hing et al.	2015b	Self-reported perceived likelihood of 11 promotional techniques encouraging them to bet on sport; Whether promotions had increased frequency/time/expenditure on gambling., or caused them to spend more time and money than intended on sports betting, or caused them or someone close to them harm; Problem Gambling Severity Index group	Perceived influence (likelihood) of advertising on behaviour	Self-reported frequency of watching eight types of televised professional sport (sports where advertising is most prominent) in the most recent season (7-point Likert; never to daily)	Embedded
13	Lopez-Gonzalez & Griffiths	2021	Self-reported perceived impact of sports gambling promotions on gambling behaviour from Hing et al., (2015a); Spanish adaptation of the Problem Gambling Severity Index	Perceived influence of advertising on behaviour	No specific measure (just the self-reported variable).	Aggregate
14	Johnston & Bourgeois	2015	Self-reported perceived gambling intentions (e.g. "in the next 12 months if a gambling company sponsors my favourite sport I probably will/will not place a bet with that sponsor....")	Perceived influence of advertising on intentions	Self-reported frequency of exposure to gambling-linked sponsorship advertising (e.g. on players' uniforms) on 5-point Likert scale (never to once a week)	Sponsorship
15	Hing et al.	2014	Self-reported perceived influence of gambling promotions on sports betting (e.g. "How strongly do you agree that X promotions make you want to bet on sports?"); Future sports betting intention for eight sports (5-point Likert; strongly disagree to strongly agree); Future other gambling intention (same measures).	Perceived influence of advertising, actual and intentions	Self-reported frequency of watching eight types of televised professional sport (sports where advertising is most prominent) in the most recent season (7-point Likert; never to daily)	Sponsorship, Aggregate

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16	Wardle et al.	2022	Self-reported impact of gambling marketing activities prompting you to spend money on gambling when they otherwise had not planned to (any vs never in the models); Problem Gambling Severity Index groups.	Perceived influence of advertising on behaviour	Cumulative self-reported past month receipt of direct marketing from gambling companies (emails, texts, social media, gambling app notifications, flyers/leaflets); Self-reported following gambling company on social media (yes/no).	Direct, Digital
17	Browne et al.	2019	Self-reported approximate amount bet on race and sports bets in previous 24 hours, and intentions to bet in following 48 hours in EMA surveys	Gambling over recall period (24 hours), actual and intended	How often they had seen/heard different advertisements and inducements in the previous 24-48 hours (never, a few times, often) in EMA surveys	Direct, TV, Inducements, Aggregate
18	Rockloff et al.	2019	Participants were given money to place bets in an experimental setting and could earn money from placing bets - outcome was riskiness of bets placed (short, medium and long odds).	Bet choice (risk)	Exposure to inducements in experimental conditions; Exposure to simulated sports highlights reels for AFL, cricket and soccer.	Inducements
19	Sproston et al.	2015	Intention to gamble (adolescents) and past year gambling behaviour (adults) on sports, racing, EGMs, other forms of gambling (Likert scale); Problem Gambling Severity Index group.	Gambling over recall period (1 year), intentions, Gambling risk level	Self-reported exposure to marketing for sports and race betting through traditional and digital means; Grouped into none, moderate and high exposure.	Traditional, Digital

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20	Schottler Consulting	2012	Self-reported influence of TAB advertising (sports and racing) on unplanned betting (5-point Likert; not at all to very frequently); and also on spending more than planned in the previous 12 months	Perceived influence of advertising on behaviour	Self-reported frequency of viewing TAB advertising (sports and racing) in the past 12 months (5-point Likert; not at all to very frequently).	Aggregate
21	Russell & Hing	2020	Self-reported impact of advertising on increasing or decreasing gambling expenditure.	Perceived influence of advertising on behaviour	Self-reported frequency of seeing gambling advertisements or promotions via 7 channels, and for 13 forms of gambling (including sport and race betting), and five types of promotions (e.g. sign up bonuses, bonus bets).	Aggregate
22	Jenkinson et al.	2023	Self-reported betting on sports and racing in the previous 12 months (less than weekly/more than weekly);	Gambling over recall period (12 months)	Self-reporting whether they had seen advertising, and how often they had seen it in the previous 12 months (4-point Likert; less than weekly to 4 or more times per week); Whether advertising had increased betting, led to impulse betting, changed what someone had bet on (new form), or initiated betting for the first time.	Traditional, Embedded, Digital, Aggregate

**Note: PGSI is sometimes used as the key outcome measure, or to separate the effects by gambling risk group.*

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APPENDIX D: DETAILED DATA EXTRACTION TABLE

No.	**Authors**	**Year**	**Study type (MMAT)**	**Statistical method**	**Outcome Variable**	**Explanatory variable**	**Coefficient Descriptive**	**Coefficient**	**Results summary**
1	Houghton & Moss	2020	Quantitative NonRandomised	2-way factorial ANOVA and independent sample ttests	Likelihood of betting (Visual Analogue Scale)	Bet complexity (high/med/low)	F-statistic	F=34.031 p<0.001	The authors find that participants are significantly less likely to bet and would spend lower amounts on high complexity bets compared to medium complexity, and on medium compared to low. They are also significantly more likely to bet on medium complexity bets shown on affiliate accounts compared to operator accounts. There is no significant interaction for money spent.
						Account type (operator/affiliate)	F-statistic	F=5.154 p=0.025	
						Account type*bet complexity	F-statistic	F = 3.781 p=0.025	
					Amount they would spend (£)	Bet complexity (high/med/low)	F-statistic	F=24.837 p<0.001	
						Account type (operator/affiliate)	F-statistic	F=1.494 p=0.225	
						Account type*bet complexity	F-statistic	F=2.695 p=0.07	
2	Noble et al.	2022	Quantitative Descriptive	Logistic mixed regression models (with controls)	Gambled in the last 30 days	Exposure to sports/celebrities ads (Yes/No)	Odds ratio (unadjusted)	OR=1.67 p<0.001	The authors find that adolescents who are exposed to sports gambling advertising are significantly more likely to have bet in the last 30 days, engaged in 'hard' gambling in the last 30 days, and be categorised as at-risk or a 'problem' gambler. However, these do not remain significant after adjusting for confounders (gender, age, money to spend on self, number of known gamblers, socioeconomic disadvantage, perceived school achievement, attended school yesterday and school ID), Despite this, online gambling remains significant. Given that the paper does not categorise types of advert, there is the chance that adolescents are exposed to sports-related advertising online too.
					Gambled in the last 30 days	Exposure to sports/celebrities ads (Yes/No)	Odds ratio (adjusted for confounders)	OR=1.13 p=0.395	
					Engaged in 'hard gambling' in the last 30 days	Exposure to sports/celebrities ads (Yes/No)	Odds ratio (unadjusted)	OR=1.8 p<0.001	
					Engaged in 'hard gambling' in the last 30 days	Exposure to sports/celebrities ads (Yes/No)	Odds ratio (adjusted for confounders)	OR=1.05 p=0.782	
					At risk or 'problem' gambling	Exposure to sports/celebrities ads (Yes/No)	Odds ratio (unadjusted)	OR=1.93 p<0.001	
					At risk or 'problem' gambling	Exposure to sports/celebrities ads (Yes/No)	Odds ratio (adjusted for confounders)	OR=1.04 p=0.773	

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3	Roderique-Davies et al.	2020	Quantitative Randomised	2-way factorial ANOVA and independent sample ttests	Urge to gamble (comparison between sports and non-sports students)	Control video (nonsports)	F-statistic	F=0 p=1	The authors find that in the sports group, there are increased urges to gamble when faced with both the professional video with promotion and the amateur video without promotion. This highlights them as a higher risk group, and indicates that there is an innate association between gambling and football. Non-sports students are also urged to gamble when presented with the promotions. There is a significant difference between both groups, indicating that the sports students are a higher-risk group (authors report that they have a higher PGSI).
						Amateur sports video with no embedded promotion	F-statistic	F=10.71 p=0.002	
						Professional sports video with embedded promotion	F-statistic	F=7.87 p=0.007	
4	Russell et al.	2019	Quantitative Descriptive	Two-step zero inflated regression (with controls)	Any betting on microevents	Exposure to gambling advertising	Odds ratio (bivariate)	OR=0.742 p<0.001	The authors found that those with higher self-reported exposure to gambling advertising were significantly less likely to bet on microevents at all. They overall had a lower percentage of total bets made up of micro-bets, but this did not reach statistical significance.
					Any betting on microevents	Exposure to gambling advertising	Odds ratio (multivariate)	OR=0.795 p<0.001	
					Percentage of sports bets that are micro-bets	Exposure to gambling advertising	Odds ratio (bivariate)	OR=0.995 p>0.05	
5	Hing et al.	2019	Quantitative Descriptive	Descriptive statistics (%)	n/a	Relative frequency of exposure	Percentage	n/a	Results have not been reported given the large amount of descriptive statistics reported in the paper. Overall, a substantial minority of participants reported that an advertisement had ever influenced their behaviour. The greatest proportions were for TV advertisements, direct messaging, and betting websites or apps. For race bettors, all types of advertisements and inducements were more likely to prompt larger and increased frequency of betting amongst those reporting any impact. For sports bettors this was true for frequency of betting. Sports bettors reported placing less risky bets as a result of advertisements and inducements.
					n/a	Relative frequency of influence	Percentage	n/a	
6	Hing et al.	2018	Quantitative Descriptive	One-way ANOVA and multiple linear regression	Percentage of bets researched and planned in advance	Exposure to marketing	Standardised coefficient	B=0.04 p=0.068	Results suggest that there is no, or a negative, relationship between self-reported exposure to advertising and the percentage of 'impulse' bets placed before and during the game. However, some inducements might increase the number of 'impulse' bets placed during the game.
					Percentage of bets researched and planned in advance	Average frequency of inducements used	Standardised coefficient	B=-0.19 p=0.852	

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					Percentage of bets placed on impulse before the match	Exposure to marketing	Standardised coefficient	B=-0.02 p=0.304	
					Percentage of bets placed on impulse before the match	Average frequency of inducements used	Standardised coefficient	B=-0.19 p<0.001	
					Percentage of bets placed on impulse during the match	Exposure to marketing	Standardised coefficient	B=-0.06 p=0.008	
					Percentage of bets placed on impulse during the match	Average frequency of inducements used	Standardised coefficient	B=0.2 p<0.001	
7	Russell et al.	2018	Quantitative Descriptive	Zero-inflated regression models (with controls)	Intended Expenditure on betting	Exposure to texts (sports bettors)	Regression Coefficient	B=-0.024 p>0.1	For race bettors, only text messaging significantly increased actual expenditure on betting. For sports bettors both emails and texts increased actual expenditure. For intended betting this was for emails only in both groups.
					Intended Expenditure on betting	Exposure to emails (sports bettors)	Regression Coefficient	B=0.465 p<0.001	
					Intended Expenditure on betting	Exposure to texts (race bettors)	Regression Coefficient	B=0.166 p>0.1	
					Intended Expenditure on betting	Exposure to emails (race bettors)	Regression Coefficient	B=0.225 p<0.05	
					Actual expenditure on betting	Exposure to texts (sports bettors)	Regression Coefficient	B=0.832 p<0.001	
					Actual expenditure on betting	Exposure to emails (sports bettors)	Regression Coefficient	B=0.413 p<0.05	
					Actual expenditure on betting	Exposure to texts (race bettors)	Regression Coefficient	B=0.276 p<0.1	
					Actual expenditure on betting	Exposure to emails (race bettors)	Regression Coefficient	B=0.016 p>0.1	
8	Hing et al.	2017	Quantitative Descriptive	Negative Binomial regression (with controls)	PGSI score	Exposure to gambling promotions	Regression Coefficient	B=0.009 p=0.082	The final regression model indicates a non-significant impact of exposure to gambling promotions on PGSI score. However, reporting an increased subjective influence of

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					PGSI score	Subjective influence of gambling promotions	Regression Coefficient	B=0.760 p<0.001	promotions on sports betting behaviour is positively and significantly associated with PGSI score after controlling for age, gender, sponsorship response, attitudes and approval of (and exposure to) gambling promotions.
9	Hing et al.	2016	Quantitative Descriptive	Spearman's correlation and Kruskal-Wallis tests	Total PGSI score	Watching live sports at a sporting venue	Spearman's Rho	SpR = 0.26 p<0.001	Results indicate that higher self-reported watching of live sports, and subsequent exposure to advertising, is associated with significant increases in PGSI score.
						Watching televised live sports	Spearman's Rho	SpR=0.22 p<0.001	
10	Di Censo et al.	2023	Quantitative NonRandomised	2 (risk-level) by 4 (inducement type) mixed ANOVAs and hierarchical regression models	PGSI score	Stake back	Standardised coefficient	B=0.22 p=0.006	High-risk gambling scores were significant predictors of PGSI score in the models after controlling for regular gambling, impulsivity, and being male. The sign-up inducement explained the greatest variance in PGSI scores compared to other inducement methods. Findings indicate that those who are at a higher-risk of harms are more likely to believe that inducements exacerbate their gambling problems.
						Sign-up	Standardised coefficient	B=0.3 p<0.001	
						Increased odds	Standardised coefficient	B=0.23 p=0.004	
						Bonus bet	Standardised coefficient	B=0.2 p=0.016	
11	Hing et al.	2015a	Quantitative Descriptive	Summary statistics and hierarchical regression (with controls)	Intention to bet in the next 6 months	Exposure to gambling promotions during televised sport	Standardised coefficient	B=0.107 p<0.01	This study reports that exposure to advertising during televised sports significantly increases the intention of betting in the next 6 months when controlling for a number of potential confounding variables. Descriptive results also indicate that individuals with a higher PGSI score report that advertising increases their frequency, expenditure, and time spent on sports betting to a greater extent than those with a lower PGSI score.
12	Hing et al.	2015b	Quantitative Descriptive	Summary statistics (mean values) and ANOVA	Perceived influence on frequency of sports betting ('problem' gambler)	Exposure to gambling promotions during televised sport	Mean value Likert scale (1=strongly disagree, 5=strongly agree)	Mean=3.5 p<0.001	The descriptive results indicate that 'problem' gamblers report that exposure to advertising has an impact on their frequency, expenditure, and time spent betting on sports. Contrastingly, 'non-problem' gamblers report on average that advertisement do not impact their sports betting. The

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					Perceived influence on expenditure on sports betting ('problem' gambler)	Exposure to gambling promotions during televised sport	Mean value Likert scale (1=strongly disagree, 5=strongly agree)	Mean=3.5 p<0.001	difference between PGSI groups is significantly different, so the 'problem' gambling group reports a higher impact.
					Perceived influence on time spent betting ('problem' gambler)	Exposure to gambling promotions during televised sport	Mean value Likert scale (1=strongly disagree, 5=strongly agree)	Mean=3.5 p<0.001	
					Perceived influence on frequency of sports betting ('non-problem' gambler)	Exposure to gambling promotions during televised sport	Mean value Likert scale (1=strongly disagree, 5=strongly agree)	Mean=2.2 p<0.001	
					Perceived influence on expenditure on sports betting ('non-problem' gambler)	Exposure to gambling promotions during televised sport	Mean value Likert scale (1=strongly disagree, 5=strongly agree)	Mean=2.1 p<0.001	
					Perceived influence on time spent betting ('nonproblem' gambler)	Exposure to gambling promotions during televised sport	Mean value Likert scale (1=strongly disagree, 5=strongly agree)	Mean=2.1 p<0.001	
13	LopezGonzalez & Griffiths	2021	Quantitative Descriptive	Kruskal-Wallis and Chi-squared tests	Perceived impact on frequency of sports betting (difference between PGSI groups)	Exposure to gambling promotions	Kruskal-Wallis test statistic	X=247.13 p<0.05	Results indicate that the rank difference in perceived influence of advertisements are statistically significant, so higher risk gamblers report a significantly higher impact of gambling advertising on gambling behaviour compared to lower risk categories. The effect size is noted as large.
14	Johnston & Bourgeois	2015	Quantitative Descriptive	Hierarchical regression (with controls)	Intention to bet with that sponsor	Exposure to gambling sponsorship advertising	Regression coefficient	B=0.11 P<0.05	The results of this study indicate that self-reported exposure to sponsorship advertising in sport is positively associated with intentions to bet with that sponsor after controlling for a number of potential confounding factors. Additionally, perceiving that sponsorship advertising has a 'powerful' effect on oneself is associated with increased intentions to bet in the same model.
					Intention to bet with that sponsor	Perceived 'powerful' impact of gambling sponsorship	Regression coefficient	B=0.18 p<0.001	

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						advertising on oneself			
15	Hing et al.	2014	Quantitative Descriptive	Hierarchical regression (with controls)	Intention to bet on sport when 18 years old	Exposure to gambling promotions during televised sport	Correlation (bivariate)	r=0.2 p<0.05	This study indicates that exposure to gambling advertising during sport is significantly correlated with intentions to bet when 18, however this result does not remain significant when controlling for additional factors in a regression model. However, a better attitude towards the sponsor results in an increased intention to bet on sports when 18 years old.
					Intention to bet on sport when 18 years old	Exposure to gambling promotions during televised sport	Regression coefficient (multivariate)	B=-0.112 p>0.05	
16	Wardle et al.	2022	Quantitative Descriptive	Logistic regression (with controls)	Reporting that marketing had prompted unplanned gambling spend (y/n)	Low risk vs 'nonproblem' gambler	Odds ratio	OR=3.31 p<0.001	These results reveal that 'problem' sports gamblers are 17 times more likely than 'nonproblem' gamblers to report that exposure to gambling marketing has prompted unplanned gambling spend. The effects for moderate and low risk are around 3 times more than 'non-problem' gamblers. Additionally, exposure to one type of direct marketing makes participants 3.2 times more likely to report that advertising prompts unplanned gambling spend, and this rises to 5.5 times for more than one exposure to direct marketing. Exposure to a gambling brand on social media increases the likelihood of reporting that advertising has prompted unplanned gambling spend by 2.45 times compared to non-exposure.
						Moderate risk vs 'nonproblem' gambler	Odds ratio	OR=3.41 p<0.001	
						Problem' risk vs 'nonproblem' gambler	Odds ratio	OR=17.01 p<0.001	
						Received one form of direct marketing vs none	Odds ratio	OR=3.2 p<0.001	
						Received more than one form of direct marketing vs none	Odds ratio	OR=5.54 p<0.001	
						Follow a gambling brand on at least one social media platform vs none	Odds ratio	OR=2.45 p<0.05	
17	Browne et al.	2019	Quantitative Descriptive	Linear mixed effects regression models	Intended spend (race)	Aggregate exposure to messaging (advertisements)	Beta coefficient (logistic)	B=0.120 p>0.1	Results show that aggregate exposure to advertisements significantly increases actual spend for sports and race bettors, and excess spend for race bettors. Exposure to advertisements is

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					Intended spend (sports)	Aggregate exposure to messaging (advertisements)	Beta coefficient (logistic)	B=-0.151 p>0.1	not significantly associated with intended spend. Other effects show that aggregate exposure to inducements increase actual spend for both sports and race bettors. Specific inducements which have an effect are direct messages, stake-backs and TV advertisements.
					Actual spend (race)	Aggregate exposure to messaging (advertisements)	Beta coefficient (logistic)	B=0.614 p<0.01	
					Actual spend (sports)	Aggregate exposure to messaging (advertisements)	Beta coefficient (logistic)	B=0.553 p<0.01	
					Excess spent (race)	Aggregate exposure to messaging (advertisements)	Beta coefficient (logistic)	B=0.374 p<0.01	
					Excess spend (sports)	Aggregate exposure to messaging (advertisements)	Beta coefficient (logistic)	B=0.227 p>0.1	
18	Rockloff et al.	2019	Quantitative NonRandomised	Wilcoxon Signed Rank Test, ANOVA, Chi-sqd test	Odds selected (short, medium, long)	Inducements vs no inducement	Mean value	M=+ p<0.05	The results show that participants tended to choose longer, more risky, odds when an inducement was present compared to when there was no inducement present. The only inducement that showed an independent effect was Cash Rebate.
						Cash Rebate vs no inducement	Mean value	Mcb=1.66, Mni=1.55 p<0.05	
19	Sproston et al.	2015	Quantitative Descriptive	Logistic regression (with controls)	Gambled regularly on sports (adults)	Moderate exposure to sports digital marketing (compared to no exposure)	Odds ratio	OR=1.47 p<0.01	These results suggest that exposure to digital sports betting marketing is associated with regular sports betting in adults. Exposure to race betting marketing on both digital and traditional channels is also associated with gambling regularly on racing, EGMs, and other activities. In the sample of adolescents, only exposure to race marketing via digital means was significantly associated with likelihood of gambling on another activity.
					Gambled regularly on sports (adults)	High exposure to sports digital marketing (compared to no exposure)	Odds ratio	OR=3.06 p<0.01	
					Gambled regularly on horse or greyhound racing (adults)	Moderate exposure to traditional racing marketing (compared to no exposure)	Odds ratio	OR=3.07 p<0.01	

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					Gambled regularly on horse or greyhound racing (adults)	High exposure to traditional racing marketing (compared to no exposure)	Odds ratio	OR=4.11 p<0.01	
					Gambled regularly on EGMs (adults)	Moderate exposure to digital racing marketing (compared to no exposure)	Odds ratio	OR=0.86 p<0.01	
					Gambled regularly on EGMs (adults)	High exposure to digital racing marketing (compared to no exposure)	Odds ratio	OR=1.62 p<0.01	
					Gambled regularly on EGMs (adults)	Moderate exposure to traditional racing marketing (compared to no exposure)	Odds ratio	OR=2.00 p<0.05	
					Gambled regularly on EGMs (adults)	High exposure to traditional racing marketing (compared to no exposure)	Odds ratio	OR=1.72 p<0.05	
					Gambled regularly on another activity (adults)	Moderate exposure to digital racing marketing (compared to no exposure)	Odds ratio	OR=1.22 p<0.05	
					Gambled regularly on another activity (adults)	High exposure to digital racing marketing (compared to no exposure)	Odds ratio	OR=2.07 p<0.05	
					Gambled regularly on another activity (adults)	Moderate exposure to traditional racing marketing (compared to no exposure)	Odds ratio	OR=1.69 p<0.05	

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					Gambled regularly on another activity (adults)	High exposure to traditional racing marketing (compared to no exposure)	Odds ratio	OR=1.69 p<0.05	
					Likely to gamble on another activity (adolescents)	Moderate exposure to digital racing marketing (compared to no exposure)	Odds ratio	OR=5.00 p<0.05	
					Likely to gamble on another activity (adolescents)	High exposure to digital racing marketing (compared to no exposure)	Odds ratio	OR=14.28 p<0.05	
20	Schottler Consulting	2012	Quantitative Descriptive	Summary statistics (mean values)	Unplanned betting	Self-reported impact of TAB (sports) advertising	Mean value Likert scale (1= not at all , 5=very frequently)	M=1.1 range=1.1-1.9	These results indicate that participants were not likely to rate that exposure to sports betting advertising impacted unplanned spend on gambling. Results split by 'problem' gambling group also revealed low mean Likert scores (<2). However, risk of 'problem' gambling was a significant predictor of self-reported advertising influence, but the correlation was low.
					Unplanned gambling spend	Self-reported impact of TAB (sports) advertising	Mean value Likert scale (1= not at all , 5=very frequently)	M=1.1 range=1.1-1.6	
				Stepwise regression	Self-reported influence of advertising	Risk of 'problem' gambling	Partial correlations	r=0.37 p<0.001	
21	Russell & Hing	2020	Quantitative Descriptive	Summary statistics (% Likert, McNewmar-Bowker test)	Self-reported influence of advertising on gambling expenditure	Before lockdown	% reporting 'decreased a little due to advertising'	3.8%	In general, participants reported that gambling advertising did not impact their expenditure ('neither increased nor decreased') before or during lockdown. However, participants were significantly more likely to report that advertising during lockdown led to a decrease in their expenditure on gambling. This was a period when advertising temporarily reduced for usual sports betting, given the pause in live sports that occurred during the initial lockdown.
					Self-reported influence of advertising on gambling expenditure	During Lockdown	% reporting 'decreased a little due to advertising'	6.6%	
					Self-reported influence of advertising on	Comparison before and during lockdown	McNewmar - Bowker test	MB=97.53 p<0.001	

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					gambling expenditure				
22	Jenkinson et al.	2023	Quantitative Descriptive	Summary statistics (% Likert)	Self-reported increased betting	Exposure to any advertising	Percentage	34%	These descriptive results show that 20-30% of respondents report that exposure to any type of advertisement for sports betting influences their betting behaviour, including initiating betting for the first time and betting on impulse. More detailed results in the report show that younger people and those at more risk of harm were more likely to report these effects (e.g. 10% in the lower lower-risk vs 50% in the higher-risk groups).
					Self-reported bet on impulse	Exposure to any advertising	Percentage	29%	
					Self-reported change betting/try something new	Exposure to any advertising	Percentage	28%	
					Self-reported initiate betting for the first time	Exposure to any advertising	Percentage	21%	

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APPENDIX E: DETAILED QUALITY ASSESSMENT TABLE

Study Type (MMAT)	*Paper No.*	Main Q1		Main Q2		Q1		Q2		Q3		Q4		Q5	
Quantitative Randomised (experimental)		**Are there clear research questions?**	*Comments*	**Do the collected data allow the authors to address the research questions?**	*Comments*	**Is randomisation appropriately performed?**	*Comments*	**Are the groups comparable at baseline?**	*Comments*	**Are there complete outcome data?**	*Comments*	**Are outcome assessors blind to the intervention being provided?**	*Comments*	**Did the participants adhere to the assigned intervention?**	*Comments*
	3	Y	Clear aim and hypotheses reported at the end of the introduction section.	?	The small sample size and the fact that the researchers could not find a professional football control video mean that the data may not be as able to answer the research question. However, the methods are novel and perhaps a larger (nonpilot) study would be useful for confirming results.	Y	The authors use block randomisation which aims to randomise participants into groups of equal sizes.	N	The groups differ in PGSI score, although the authors explain that this is purposeful since they wish to understand the effect on those with higher vs lower risk of gambling harms.	?	The authors do not report any missing data, but do not clarify response rates.	?	The authors do not mention this but I assume that they were not blind to it given that they performed the randomisation and invited students into the experiment.	Y	All 60 participants took part in the experiment.
Quantitative Nonrandomised (experimental)		**Are there clear research questions?**	*Comments*	**Do the collected data allow the authors to address the research questions?**	*Comments*	**Are the participants representative of the target population?**	*Comments*	**Are the measurements appropriate regarding both the outcome and intervention (or exposure)?**	*Comments*	**Are there complete outcome data?**	*Comments*	**Are the confounders accounted for in the design and analysis?**	*Comments*	**During the study period, is the intervention administered (or exposure occurred) as intended?**	*Comments*
	1	Y	Clear hypotheses stated on page 390.	Y	The author's measure individual response to social media advertising and compare results between adverts on operator and affiliate accounts, which relates directly to their hypotheses.	N	Whilst it is understandable why the authors used these sampling methods, the final sample has much higher rates of moderate-risk and highest-risk gambling, as well as a much higher percentage of individuals with university education.	?	The PGSI is a validated clinical measure of gambling behaviour, and is one of the most widely used in the gambling literature. Whilst VAS are commonly used to rate pain, there is no indication whether this is appropriate for the current study. The mock advertisements are not likely to reflect real-life advertisements due to budget restrictions, but the authors acknowledge this as a limitation.	?	The authors impute data but do not give a reason why this is appropriate, and do not address/test whether it may cause bias.	?	There is some mention of demographic and gambling characteristics, but the authors do not explain how/whether the method they use controls for these.	Y	The authors have 100/145 participants with at least 50% response rate for the advertisements.

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	10	Y	The authors clearly state their aims and objectives under 'The Present Study' section	Y	The authors have control over exposure to advertising inducements, and measure individual perceived impact immediately after exposure.	N	The authors use a prior sample size calculation and a panel to recruit participants, but their sampling method is non-representative because authors are interested in individuals who have prior experience with sports betting.	Y	The authors provide a detailed explanation of the development and appropriateness of their measurements, quoting Cronbach's alpha statistics.	?	There were a large number of individuals who did not complete the survey, and 49 were excluded at a later date due to issues with their responses. However, using an online panel tends to reduce nonresponse since these individuals are signed up to complete surveys.	Y	The use of hierarchical regression models with some controls has strength. The authors may have included additional demographic and gambling-related controls, if they had the data available.	?	A large number of individuals did not complete the survey and this may bias results if this is for reasons correlated with their betting behaviour.
	18	Y	The authors state clear research questions at the end of the introduction section.	Y	The authors utilise experimental methods to measure the effect of exposure to inducements on the selection of odds by surveying participants, whilst controlling for exposure directly.	N	This study oversamples higher frequency gamblers and as a result there is an over-representation of 'problem' gamblers in the sample. However, the authors acknowledge this. This is also common in the gambling advertising literature to ensure that sufficient numbers of individuals are in each gambling risk group (the authors specifically tested for differences by PGSI group).	Y	The authors use previously explored inducement types, a valid measure of gambling behaviour (PGSI) and are able to directly control for exposure to advertising given the experimental setup.	?	The authors do not discuss any missing data, only that participants were dropped because they did not meet inclusion criteria (e.g. place of residence), or did not give complete answers at the soft launch.	Y	The use of an experimental setup helps control for potential confounders and makes the study more internally valid.	Y	The experimental setup means that the authors had full control over exposure to the different types of inducement.
Quantitative Descriptive (observational)		**Are there clear research questions?**	*Comments*	**Do the collected data allow the authors to address the research questions?**	*Comments*	**Is the sampling strategy relevant to address the research question?**	*Comments*	**Is the sample representative of the target population?**	*Comments*	**Are the measurements appropriate?**	*Comments*	**Is the risk of nonresponse bias low?**	*Comments*	**Is the statistical analysis appropriate to answer the research question?**	*Comments*

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	2	Y	The authors clearly state their aims at the end of the introduction section.	Y	The authors collect data on (1) adolescents self reported exposure to different types of advertisements (2) their gambling behaviour, including gambling in the past month and at risk/'problem' gambling.	Y	Yes, they are able to recruit a random sample that is more representative of the population of interest.	Y	The authors use a large, randomised, and weighted study on adolescents' alcohol and drug use, and gambling.	?	The gambling questions were developed through an interactive process including: literature search, expert advice, and pilot testing. Students were given a definition of gambling before answering the questions. The authors used a reliable and valid measure of gambling behaviour (DSM-IV), and justified their choice of using a dichotomous response option. Authors used and adapted an already tested measure of advertising exposure (Hing et al 2014). However, the categorisation of advertising exposure did not acknowledge any cross-over between advertising types (e.g. sports advertisements can also be online and TV).	Y	The authors are already using a large, well established survey of adolescent behaviours.	Y	The authors use logistic models which are appropriate and easy to interpret. They also adjust for a number of important demographic and gambling-related confounders. The sample size is also an advantage of this study.
	4	Y	The authors clearly state their aims at the end of the introduction section.	Y	Whilst they cannot comment on causality, the data does allow the authors to investigate their research hypotheses.	Y	The authors explain that their sampling strategy is purposeful and allowed them to recruit sufficient numbers of respondents at varying levels of 'problem' gambling severity.	N	The authors state that this is a convenience sample and that the sample is not representative of the general population of Australia, and they explain why this was done.	?	The authors use well validated measures and reference Cronbach's alpha statistics in their methodology section. However, their measure of gambling advertising was self reported and only ranged from 'never' to 'almost always'. They were also measuring a type of betting that is illegal in Australia.	Y	The authors do not discuss response rates. However, they have used an online panel which usually increases response rates, and the quality of data collected.	?	Whilst the authors use appropriate statistical models, the main aim of the study wasn't to measure the relationship between advertising and behaviour. The association measured is potentially biased.
	5	Y	The authors explain their overall aim at the end of the introduction section.	?	Whilst the data does answer the question, it is very descriptive data.	Y	Over-sampling higher risk gamblers is common in the gambling literature to ensure that there are enough participants in each risk category.	N	The authors acknowledge this as a limitation, but explain why this is the case.	Y	Whilst exposure to advertising is self reported, the authors' use EMA methods which can minimise recall bias by measuring exposure as close to the exposure time as possible.	?	The authors' do not report the percentage of surveys completed by all participants.	N	There is no statistical analysis, this is a descriptive study.

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	6	Y	The authors clearly state their aims and hypothesis at the end of the introduction section.	Y	The authors collect selfreported data on advertising exposure, watching of sports, uptake of inducements and percentage of bets placed on 'impulse' before and during the game.	Y	Over-sampling higher risk gamblers is common in the gambling literature to ensure that there are enough participants in each risk category.	N	The authors explain why they have collected a nonrepresentative sample: cost considerations and to ensure that there are sufficient numbers of respondents in each gambling risk group.	?	The measurement of betting relies on the respondent understanding which bets they have placed on ' impulse' in the form of a percentage of total bets. This is quite a subjective question and is most likely subject to recall bias. The authors also control for both watching of sport, and exposure to advertisements which may be correlated. However, they use other validated measures such as 'problem' gambling severity, and report Cronbach's alpha for a number of their measures.	Y	The authors do not discuss response rates. However, they have used an online panel which usually increases response rates, and the quality of data collected.	?	The regression models control for a number of important confounding demographic and gambling variables, but the measures used might not be accurately measuring what they intend to.
	7	Y	The authors clearly state their aims and hypothesis at the end of the introduction section.	Y	The authors use novel EMA methods to collect real-time data on exposure to direct advertising, and expenditure on betting. They also collect actual direct messages from individuals to examine their content.	Y	Over-sampling higher risk gamblers is common in the gambling literature to ensure that there are enough participants in each risk category.	N	The authors collected a small convenience sample due to budget constraints.	Y	The use of EMA helps to reduce recall bias in the measurements, especially in exposure to advertising by collecting the data as close to the exposure as possible. The authors use a widely used measure of gambling behaviour (PGSI).	?	The sample is very small and the authors do not report how many individuals complete each survey, but do report that 65% completed 6/7 surveys. The percentage of direct messages forwarded to the authors' is variable and can be low for sports bettors.	Y	They use zero inflated regression models with control variables to estimate effects for two groups of bettors (race and sports). Their use of EMA also increases the ecological validity of the models, and reduces recall bias. They also controlled for individual random effects to account for differences in individual betting, and for PGSI score which strengthen the models.
	8	Y	There are clear aims and hypotheses at the end of the introduction section.	Y	The authors collect data on 'problem' gambling scores, and exposure to gambling promotions (using a proxy measure) to estimate this relationship. They also collect data on confounding variables such as age and gender.	Y	Over-sampling higher risk gamblers is common in the gambling literature to ensure that there are enough participants in each risk category.	N	The authors explain why the sample is not representative (this was not their aim).	Y	The authors clearly explain each measure used and provide Cronbach's alpha statistics for each. The use of a proxy measure for advertising exposure is useful for overcoming issues with recall of advertising exposure, but it is also still a self-reported variable so may suffer bias.	Y	The authors have used a panel to recruit participants which enhances completeness of the data.	Y	The use of Negative Binomial regression with control variables is a strength of this study. Other variables might have been useful to control for, such as other gambling behaviours, if they were available in the dataset.

	9	Y	The authors clearly state their aims at the end of the introduction section.	?	The results are very descriptive, but they do answer the question.	Y	The authors deliberately oversample 'at least fortnightly' bettors to ensure sufficient numbers of 'problem' and at-risk gamblers.	N	See previous comment. The authors note that only 13% of the Australian population gambles on sport, so gaining a random sample of sports bettors is not feasible (needs purposive methods).	?	The use of a proxy measure for advertising exposure is useful for overcoming issues with recall of advertising exposure, but it is also still a self-reported variable so may suffer bias. It also may not be directly measuring exposure to advertising (although they are likely strongly correlated). The outcome variable is a well validated measure of gambling behaviour.	Y	The authors do not discuss response rates. However, they have used an online panel which usually increases response rates, and the quality of data collected.	?	Looking at descriptive statistics is useful, but it doesn't control for potential confounding variables in the relationship between advertising and behaviour. So it is hard to establish causality for each single risk factor.
	11	Y	The authors state clear hypotheses at the end of the introduction section.	Y	The authors collect data on self-reported perceived impact of advertising, and watching live sports (proxy for advertising exposure). They use descriptive models and hierarchical regression models with controls to explore this relationship.	Y	The authors use an online panel to collect a large sample of data.	Y	Online panels are representative of the population by gender and metro/non-metro location. People aged 45-74 were only slightly overrepresented.	Y	The authors provide a clear table with explanations of where the measures are derived from, with Cronbach's alpha coefficients where applicable.	Y	The authors do not discuss response rates. However, they have used an online panel which usually increases response rates, and the quality of data collected.	Y	However they could have controlled for additional demographic characteristics given that this was a large, detailed sample with information on income/area of residence/age etc...
	12	Y	There is a general aim stated at the end of the introduction section.	?	The results are very descriptive, but they do address the overall aim.	Y	Purposive samples are common in the gambling advertising literature, and the authors acknowledge why they have chosen to do this (ensure sufficient numbers in each risk group). They also explain why and how they collected an additional sample from a pool of individuals who had previously completed a study.	N	But the authors explain why they have chosen this sample. They want to look at differences between PGSI groups, so need to ensure that there are sufficient numbers in each group (oversampling higher risk gamblers).	?	The authors have used a widely used and validated measure of gambling behaviour (PGSI). However they do not reference the validity of the other measures used. These appear to be the same ones referenced in the above paper (Hing et al., 2015b).	Y	The use of a research panel generally increases response rates and the quality of data.	?	Whilst the authors acknowledge that the study provides modest and preliminary knowledge about the topic, this is a limitation of the paper. The results are descriptive, rely on self-report and do not control for other confounding factors.

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	13	Y	The paper clearly states a number of aims in the section titled 'The Present Study'	Y	The authors collect data on perceived impact of advertising on behaviour, and the PGSI score of each individual which allows them to test the relationship between the two.	Y	The authors use a panel which helps to reduce missing data/non-response, and over-sample higher risk gamblers.	N	The sample has a higher percentage of males, and appears to have a high percentage of those with a bachelor's degree or higher (although this common in online panel samples). The authors explain why they have sampled this way (over-sample higher risk gamblers).	Y	Each measure is well described and has an associated Cronbach's alpha statistic.	Y	The use of a research panel generally increases response rates and the quality of data.	?	The analysis is directly related to the aims of the study and uses non-parametric statistical tests to explore whether Reponses between PGSI groups are statistically significant. Given that the authors have demographic information, they could have used regression models to control for all factors in the model at the same time to improve the robustness of their results.
	14	Y	The authors present clear hypotheses (relevant ones under 'intentions to gamble with sponsors')	Y	The authors collect data on sponsorship exposure, intentions to use that sponsor, and a number of other demographic and gambling characteristics to explore this relationship.	Y	Their use of a quota sample allows the authors' to look at the impact of this relationship in a broader context (not just on high frequency sports bettors).	?	The authors use a panel and quota sampling methods which should improve sample representativeness, but they do not discuss how the sample compares to the population.	?	The authors use previously tested measure of gambling intentions and quote Cronbach's alpha statistics for internal reliability. However, their measure of gambling involvement and exposure to advertising do not reference a previously used measure or a measure of internal reliability.	?	Although the authors use an online panel, they report an initial response rate of 24% with a dropout rate of 11%. However, they do collect 511 useable responses.	Y	The authors use hierarchical regression models and control for a number of potential demographic and gambling-related characteristics in the model.
	15	Y	The authors state clear hypotheses at the end of the introduction section.	Y	The authors collect selfreported survey data on adolescent exposure to advertising (proxied by sports watching) and on their intentions to bet on sports at 18 years old.	?	The authors use a panel to collect a general sample of adolescents to try and make the sample more representative. However, the authors cannot guarantee the the final sample is representative of the population of interest, but it also does not over-sample those more interested in sports watching.	N	The sample is representative in terms of gender, the authors' state that it might not be representative based on other variables. The authors' cannot comment on the representativeness compared to the general population.	Y	Each measure is well described and has an associated Cronbach's alpha statistic.	Y	The use of a research panel generally increases response rates and the quality of data.	Y	The authors use hierarchical regression models with controls.
	16	Y	The authors' clearly state their aims in their abstract and introduction.	Y	The authors have a large dataset measuring unplanned gambling spend prompted by marketing, exposure to, and awareness of, gambling marketing, and PGSI score.	Y	The authors use a large dataset of British sports bettors from an online survey. Participants are recruited via YouGov which is a trustworthy and representative survey platform.	Y	The authors weight the sample by age, sex, and region with respect to the population profile of Great Britain.	Y	Each measure is well described and comes from the larger cohort survey, which has likely undergone rigorous testing prior to collection of data. Cronbach's alpha is reported for PGSI score.	Y	The authors are using a sample from a cohort study recruited via an online platform which likely increases response rates and completeness of data.	Y	The authors use logistic regression models with a number of important control variables (sex, age, educational attainment, employment and deprivation).

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	17	Y	There is a clear aim stated at the end of the introduction section.	Y	The authors use novel EMA methods to collect real-time data on exposure to advertisements and inducements and intended and actual gambling spend over a period of time.	Y	The authors targeted a sample of sport and race bettors in Australia since they were a group of interest.	N	The sample has an over-representation of higher risk gamblers which is often observed in internet panel samples, and also amongst purposive samples of sports bettors. There was attrition in the EMA surveys which means the final sample may differ slightly to the general population (differential attrition by age for race bettors).	Y	Using EMA ensures that data is collected as close as possible to time of exposure or time of expenditure on gambling, so the risk of recall bias is reduced. The surveys used a list of advertisements from a previous national study.	N	There was significant attrition in this EMA surveys, which potentially differed by age in the race betting sample. These types of surveys are a higher burden on participants, which may explain this.	Y	The authors carefully explain their choice of methods, and use linear mixed models with controls (e.g. Saturdays) to measure the effects.
	19	Y	The authors state a clear objective at the beginning of chapter 5 (online survey).	Y	The authors collect a large sample of data on self-reported exposure to sports and race betting advertising and gambling behaviour.	Y	The authors use purposive sampling methods to recruit using an online panel.	N	The authors explain that it was not within their budget to get a randomised representative sample since this would require too large a sample size to ensure there were sufficient numbers in each group.	?	Some measures are based on measures used in a previous study. There are no references to statistics to test the validity or reliability of the measures.	Y	The authors recruit using an online panel which should maximise completeness of data.	Y	The authors use logistic regression models with controls for other advertising-related and demographic variables.
	20	Y	The authors state the broad aim of the quantitative research segment in their introduction and at the beginning of the relevant chapter.	?	Whilst the authors collect data on self reported unplanned gambling behaviour, this might be difficult for participants to answer correctly.	Y	The authors use a weighted sample which improves the representativeness of the sample (in terms of it being comparable to the betting population in New Zealand).	N	Whilst the authors do weight the sample, they acknowledge the use of a panel and the non-generalisability of the sample to the entire New Zealand population.	?	There is no clarification of where the measures used are derived from.	Y	The use of a research panel generally increases response rates and the quality of data.	?	For the relationship between advertising and behaviour there are only summary statistics (mean Likert values). The stepwise regression models are only used for looking at predictors of selfreported influence of advertising on behaviour.
	21	Y	The authors report four clear research questions in the background section of the report.	Y	The authors use an online survey to collect a large sample of data on self-reported exposure to advertising and impact of advertising on expenditure before and during the initial lockdown period. The defined (and important) periods may have helped participant recall.	Y	The use of purposive sampling methods using an online panel and participants from a previous study allowed the authors to collect a much larger sample of data.	N	The authors used purposive methods because they were interested in recruiting regular bettors, and therefore the sample was not representative of the population (although the authors have reasons for this).	?	There is no clarification of where the measures used are derived from, but they appear to use a Likert scale when asking respondents to report the impact of advertising on their expenditure.	Y	The use of a research panel and participants who had previously completed a study likely increases response rates and the quality of data.	?	The results are descriptive, although the authors acknowledge this in the report.

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	22	Y	Though there are no specific research questions reported (the document is a research snapshot summary), there are clear aims under the 'our survey' section.	Y	Despite the descriptive nature of the results, the collected data do allow the authors to understand exposure and impact of gambling advertising overall and within specific subgroups of interest.	Y	The authors collect a large general community sample which is aligned to population parameters. They are able to look at different subgroups including age, gender and gambling risk group.	Y	The sample is representative in terms of gender, age and location of residence (metro vs non-metro). The sample was aligned with BAS population parameters.	?	There is no clarification of where the measures used are derived from, but they use a Likert scale ('strongly agree' to 'strongly disagree').	Y	The authors collect survey data with a large research company and online research unit (panel) which improves completeness of the data.	?	The results are descriptive, but the authors are able to divide the results by subgroup which is a strength of the study.

**Response options: Y (yes), N (no), ? (can't tell)*

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10.2 Appendix 2: Appendix for Chapter Four

Description	*Wording*	*Response Options*	*Validity*
Gambling Frequency	Thinking now about gambling on football. How often have you gambled on a football game during the last 12 months?	Every day, 5-6 days a week, 3-4 days a week, once a week, 1-2 times per month, once every couple of months, 1-2 times per year, never at all	Adapted from HSE (2019) drinking frequency question
Gambling Activities	Have you spent any money on the following activities in the last 12 months (select all which apply)?	National lottery, scratchcards, football pools, bingo, fruit/slot machines, virtual gaming machines in bookmakers, table games in a casino, poker in a pub tournament/league/club, online gambling games, online betting with a bookmaker on an event/sport, betting on horse races, betting exchange, dog races, sports events in a bookmaker, other events in a bookmaker (or on phone)	HSE (2018)
Favourite Operator	Who is your favourite/chosen operator to bet with?	William Hill, Betfair, Ladbrokes, Coral, Sky Bet, Paddy Power, Other	YouGov 2019 top rated operators (non-lottery/bingo)
Number of Betting Accounts	During the last 12 months, how many betting accounts did you hold with different betting agencies?	Open box	Adapted from Hing et al (2018)
Gambling Severity	9 questions on gambling behaviours	1=never, 4=almost always	PGSI (Ferris & Wynne, 2001)
Drinking Behaviours	3 Questions on drinking behaviours	Frequency of drinking, number of drinks, number of binge episodes	AUDIT-C (Bush et al., 1998; Bradley et al., 2003)
General Health	How is your health in general?	Likert scale: 1=very good, 5=very bad	HSE (2018)
Mental Health	Have you been feeling unhappy or depressed recently?	Likert scale: 1=not at all, 4=much more than usual	HSE (2018)
Life Satisfaction	Overall, how satisfied are you with your life nowadays?	VAS: 1=not at all, 10=completely	HSE (2018)
Social Gambling	Do you often place bets when you are on your own?	Never, sometimes, most of the time, almost always	Pilot question (using response options from PGSI)
Followed Match	Did you follow the match in any other way?	No, Radio, Online (social media), text feed (e.g. BBC), within betting apps, other (please specify)	Pilot question
Timing of Bet	When did you place (your first) the bet?	Before the day of the match, more than an hour before, within the hour before, during the match	Adapted from Hing et al (2018)

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Excessive Betting	To what extent do you agree with this statement: I bet more than I had intended to on these matches?	Likert scale: 1=strongly agree, 5=strongly disagree	Adapted from Hing et al (2018)
Intentions to Bet	To what extent do you agree with this statement: I intend to place a bet on a World Cup qualifying match on 29th March	Likert scale: 1=strongly agree, 5=strongly disagree	Adapted from Hing et al (2018)
Loss Chasing	When you gambled on the WC qualifying matches, did you go back another day to try to win back any money you had lost?	Yes, No, N/A	Adapted from PGSI

Appendix 2 Table 1: Details of the survey questions used in the feasibility study

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Providing screenshots of betting transaction statements

You have agreed to provide screenshots of your transaction statements from your online betting accounts in another survey link.

We ask you now to go to your online betting account (or accounts), go into "my account" and then go into either your "account statement", "transactions", or "transaction history". This will differ depending on your chosen gambling operator.

Once you have done this, we would ask you to take screenshots of these accounts from the last two weeks (since 21st March 2022). There should be no financial or personal information visible in these statements (e.g. name, username, bank account or card number). If these are visible then it is likely you are looking at the wrong statement and we ask that you do not attempt to upload these.

Tomorrow, you will be sent a link to another survey which will ask you to upload these screenshots. You must access this survey on a computer or laptop, and not on your mobile device. Following your completion of this, you will be reimbursed a further £5 for your additional time. We would like to remind you that once these screenshots have been transcribed they will be permanently deleted.

Thank you for choosing to take part in this additional research. If you require any additional information on how to access your transaction statement, please use the information provided on your chosen gambling operators website.

Appendix 2 Figure 1: Instructions provided to participants for obtaining screenshots of betting account statements

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Date	Match	Sport	Bet type	Detail	Stake	Time	Win/Loss	Winnings
19/03/2022	Hearts Vs Livingston	Football	Treble	Hearts to win				
19/03/2022	St Mirrren Vs Dundee	Football	Treble	St Mirren to win				
19/03/2022	Aston Villa Vs Arsenal	Football	Treble	Both teams to score	£10		Loss	-£10
21/03/2022	Wakiso Giants FC Vs UPDF FC	Football	Single	Correct score	£2		Loss	-£2
24/03/2022	Evgenly Elizarov Vs Maxim Schjinov	Table Tennis	Multiple	Match winner				
24/03/2022	Valery Kasimtsev Vs Kristina Frolova	Table Tennis	Multiple	Match winner				
24/03/2022	Dmitry Berlin Vs Maxim Kolos	Table Tennis	Multiple	Match winner	£5	11:03	Win	£22.20
24/03/2022	South Korea Vs Iran	Football	Multiple	Match Result				
24/03/2022	Sweden Vs Czech Republic	Football	Multiple	Match Result				
24/03/2022	Wales Vs Austria	Football	Multiple	Match Result	£5	11:00	Loss	-£5.00
24/03/2022	Mikhail Katanov Vs Vasily Deryugin	Table Tennis	Multiple	Match winner				
24/03/2022	Maria Vinogradova A Vs Oleg Denisevich	Table Tennis	Multiple	Match winner				
24/03/2022	Sorbalo Vladislav Vs Nikita Pikulskiy	Table Tennis	Multiple	Match winner	£5	12:00	Loss	-£5.00
24/03/2022	Lebanon Vs Syria	Football	Multiple	Match Result				
24/03/2022	Vietnam Vs Oman	Football	Multiple	Match Result				
24/03/2022	South Korea Vs Iran	Football	Multiple	Match Result	£5	11:59	Loss	-£5.00
24/03/2022	Vietnam Vs Oman	Football	Multiple	Match Result				
24/03/2022	South Korea Vs Iran	Football	Multiple	Match Result				
24/03/2022	Dmitriy Gorbunov Vs Maksim Klimovich	Table Tennis	Multiple	Match winner				
24/03/2022	Falck Mattias/Karlsson Kristian Vs Ricardo Walther/Ort K	Table Tennis	Multiple	Match winner	£5	11:52	Loss	-£5.00
24/03/2022	Solomon Islands Vs Tahiti	Football	Multiple	Match result				
24/03/2022	PAOK FC B Vs Pierikos FC	Football	Multiple	Match result	£10	14:09	Loss	-£10.00
24/03/2022	PAOK FC B Vs Pierikos FC	Football	Multiple	Match result				
24/03/2022	Thailand Vs Nepal	Football	Multiple	Match result	£5	13:15	Loss	-£5.00
24/03/2022	Vietnam Vs Oman	Football	Multiple	Match result				
24/03/2022	FC Copenhagan (reserves) Vs FC Nordsjaelland (reserves)	Football	Multiple	Match result				
24/03/2022	PAOK FC B Vs Pierikos FC	Football	Multiple	2nd goal score (team)	£7	13:03	Loss	-£7.20
24/03/2022	Sweden Vs Czech Republic	Football	Multiple	Extra time goals (under (0.5))				
24/03/2022	Paraguay Vs Ecuador	Football	Multiple	Match Result				
24/03/2022	Uruguay Vs Peru	Football	Multiple	Match Result	£10	21:57	Loss	-£10.00
24/03/2022	Portugal Vs Turkey	Football	Multiple	1st half result				
24/03/2022	Italy Vs North Macedonia	Football	Multiple	1st half result				
24/03/2022	Hungary Vs Serbia	Football	Multiple	Match result	£10	19:05	Loss	-£10.00
29/03/2022	Sweden U19 Vs Czech Republic U19	Football	Multiple	Match result				
29/03/2022	Igor Elistratov Vs Teshaboev Kutbidillo	Table Tennis	Multiple	Match winner				
29/03/2022	Oldham Athletic Vs Leyton Orient	Football	Multiple	Match Result				
29/03/2022	England Vs Cote d'Ivoire	Football	Multiple	Match Result				
29/03/2022	Austria Vs Scotland	Football	Multiple	Match Result	£5	17:21	Loss	-£5.00
29/03/2022	Cyprus Vs Estonia	Football	Multiple	Match Result				
29/03/2022	Finland Vs Slovakia	Football	Multiple	Match Result				
29/03/2022	Montevideo City Torque (reserves) Vs Danubio FC (reserves	Football	Multiple	Match Result	£5	17:18	Loss	-£5.00
29/03/2022	Cyrus U21 Vs Iceland U21	Football	Multiple	Match Result				
29/03/2022	Bosnia and Herzegovinia U19 Vs France U19	Football	Multiple	Match Result				
29/03/2022	Congo Vs Sierra Leone	Football	Multiple	Match Result	£5 (fre	14:11	Loss	£0.00
29/03/2022	England Vs Cote d'Ivoire	Football	Multiple	Rest of the Match				
29/03/2022	Wales Vs Czech Republic	Football	Multiple	Match result				
29/03/2022	Austria Vs Scotland	Football	Multiple	Match result	£8.22	20:23	Loss	-£8.22
29/03/2022	Corinthian Casuals FC Vs Haringey Borough FC	Football	Multiple	Match result				
29/03/2022	Denmakr U21 Vs Belgium U21	Football	Multiple	Match result				
29/03/2022	Netherlands Vs Germany	Football	Multiple	Match result	£5	20:21	Win	£75.00
29/03/2022	Belgium Vs Burkina Faso	Football	Multiple	1st half result				
29/03/2022	Republic of Ireland Vs Lithuania	Football	Multiple	1st half result				
29/03/2022	England Vs Cote d'Ivoire	Football	Multiple	1st half result				
29/03/2022	France Vs South Africa	Football	Multiple	1st half result	£5	19:18	Loss	-£5
29/03/2022	Japan Vs Vietnam	Football	Double	Draw				
29/03/2022	Azerbaijan Vs Latvia	Football	Double	Under 0.5 goals	£1.50		Loss	-£1.50
31/03/2022	FC Santa Rosa Vs Atletico Junior	Football	Double	Draw				
31/03/2022	Altos Pl Vs Fluminese EC Pl	Football	Double	Draw	£7.37	17:07	Win	£74.25
31/03/2022	CA Nueva Chicago Reserves Vs CA Brown	Football	Double	Draw				
31/03/2022	San Telmo Reserves Vs Villa Dalmine Reserves	Football	Double	Draw	£1		Win	£7.37

Appendix 2 Figure 2: Participant 12's screenshotted betting transaction data (transcribed)

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Date	Match	Sport	Bet type	Detail	Stake	Time	Win/Loss	Winnings
19/03/2022	Brisbane Olympic FC Vs Brisbane City	Football	Builder	Over 2.5 goals, both teams to score	£5	10:13	Loss	-£5
20/03/2022	Nottm Forest V Liverpool	Football	Builder (trebles)	L win, over 1 goals for L, Over 1 card for NF	-			
20/03/2022	Tottenham Vs West Ham	Football	Builder (trebles)	Over 2 goals in match, both teams receive a card, over 2 cards in match, both to score	-			
20/03/2022	Leicester Vs Brentford	Football	Builder (trebles)	L win, Over 5 corners combines, over 0 cards combined	£5	11:00	Loss	-£5
20/03/2022	Leicester Vs Brentford	Football	Builder	3 specific players to be booked	£5	13:28	Loss	-£5
02/04/2022	Tranmere Vs Carlisle	Football	Bet boost	Tranmere to win	£5	14:34	Loss	-£5

Appendix 2 Figure 3: Participant 13's screenshotted betting transaction data (transcribed)

Date	Match	Sport	Bet type	Detail	Stake	Time	Win/Loss	Winnings
21/03/2022	Millonarios Women Vs Atletico Nacional Women	Football	Double (boosted)	Over/under first half 0.5		01:15		
21/03/2022	Atlas FC Vs Guadalajara Chivas	Football	Double (boosted)	Over/under first half 0.5	£4	01:00	Loss	-£4
21/03/2022	Millonarios Women Vs Atletico Nacional Women	Football	Double (boosted)	First half result (Atletico Nacional Women)		01:15		
21/03/2022	Atlas FC Vs Guadalajara Chivas	Football	Double (boosted)	First half result (Atlas FC)	£1	01:00	Loss	-£1
21/03/2022	Los Angeles FC Vs Vancouver Whitecaps	Football	Single	Over/under first half 0.5	£5.00	02:00	Win	£9
21/03/2022	Los Angeles FC Vs Vancouver Whitecaps	Football	Single	Next team to score (Los Angeles FC)	£9	02:00	Win	£13.80
21/03/2022	Rosso Kumamoto Vs V-Varen Nagasaki	Football	Single	Over/under first half 0.5	£4	04:00	Win	£5.83
21/03/2022	YC Manora Vs Sporting Clube de Goa	Football	Single	Over/under first half 0.5	£0.83	10:30	Win	£1.25
21/03/2022	Naya Basti Yuwa Vs Ranipokhari Corner Team	Football	Double	Next team to score (Ranipokhari Corner Team)		10:15		
21/03/2022	YC Manora Vs Sporting Clube de Goa	Football	Double	Next team to score (Sporting Club de Goa)	£1	10:30	Loss	-£1
21/03/2022	Naya Basti Yuwa Vs Ranipokhari Corner Team	Football	Double	Match Betting		10:15		
21/03/2022	YC Manora Vs Sporting Clube de Goa	Football	Double	Match Betting	£1	10:30	Loss	-£1
21/03/2022	San Lorenzo Reserves Vs CA Huracan Reserves	Football	Single	Over/under first half 0.5	£14.25	12:00	Loss	-£14.25
21/03/2022	UTC de Cajamarca Vs Sport Huancayo	Football	Single	Over/under first half 0.5	£3	20:30	Loss	-£3
21/03/2022	Bracknell Town FC Vs Tooting & Mitcham United	Football	Treble	Match Betting		19:45		
21/03/2022	Tenerife Vs Almeria	Football	Treble	Match Betting		20:00		
21/03/2022	UTC de Cajamarca Vs Sport Huancayo	Football	Treble	Match Betting	£1	20:30	Loss	£1
21/03/2022	Concarneau Vs Chateauroux	Football	Double	Match Betting		19:45		
21/03/2022	Tenerife Vs Almeria	Football	Double	Match Betting	£1	20:00	Loss	-£1
21/03/2022	UTC de Cajamarca Vs Sport Huancayo	Football	Single	Match Betting	£5.50	20:30	Loss	-£5.50
21/03/2022	UTC de Cajamarca Vs Sport Huancayo	Football	Single	Match Betting	£3.50	20:20	Win	£10.91
21/03/2022	Concarneau Vs Chateauroux	Football	Double	Match Betting		19:45		
21/03/2022	UTC de Cajamarca Vs Sport Huancayo	Football	Double	Match Betting	£1	20:30	Loss	-£1
21/03/2022	SC International Women Vs Sao Paulo Futebol Clube Women	Football	Single	Over/under first half 0.5	£9.25	23:00	Win	£13.36
21/03/2022	CA Boston River Vs Defensor Sporting	Football	Single	Over/under first half 1.5	£1	22:00	Loss	-£1
21/03/2022	Defensa Y Justica Vs Arsenal de Sarandi	Football	Single	First half total goals	£1	22:15	Loss	-£1
21/03/2022	Deportes Antofagasta Vs Deportes Union La Calera	Football	Single	Over/under total goals 0.5	£1	21:00	Win	£2.25
21/03/2022	Deportivo Cali Vs Atletico Nacional	Football	Single	Over/under first half 0.5	£13.36	23:10	Win	£21.58
21/03/2022	Deportivo Cali Vs Atletico Nacional	Football	Single	Over/under first half 1.5	£3.58	23:10	Win	£6.27
21/03/2022	Deportivo Cali Vs Atletico Nacional	Football	Single	Over/under first half 2.5	£4.27	23:10	Win	£7.83
22/03/2022	Sheffield Wednesday U23 Vs Ipswich Town U23	Football	Double	Match Betting		13:00		
22/03/2022	Barnsley U23 Vs Swansea City U23	Football	Double	Match Betting	£1.25	13:00	Loss	-£1.25
22/03/2022	Albion FC reserves Vs Montevideo Wanderers reserves	Football	Single	Next team to score	£1.70	14:00	Cashed ou	£2.95
22/03/2022	Albion FC reserves Vs Montevideo Wanderers reserves	Football	Single	Next team to score	£2.30	14:00	Cashed ou	£1
22/03/2022	FC Bayern Munich (women) Vs Paris St-Germain (women)	Football	Single	Over/under first half 0.5	£2.64	17:45	Win	£4.75
22/03/2022	FC Bayern Munich (women) Vs Paris St-Germain (women)	Football	Treble	First half result		17:45		
22/03/2022	SSV Ulm 1846 Vs FC Astoria Walldorf	Football	Treble	First half result		18:00		
22/03/2022	SpVgg Greuther Furth II Vs SV Wacker Burghausen	Football	Treble	First half result	£1	18:00	Loss	-£1
23/03/2022	Csd Arzua Vs Silva SD	Football	Double	Over/under first half 0.5		19:30		
23/03/2022	Ourense CF Vs SD Sofan	Football	Double	Over/under first half 0.5	£2.50	19:30	Win	£7.50
23/03/2022	Csd Arzua Vs Silva SD	Football	Double	Over/under first half 0.5		19:30		
23/03/2022	AA Caldense Vs Atletico Mineiro	Football	Double	Over/under first half 0.5	£1.50	19:30	Win	£4.88
23/03/2022	Manaus FC AM Vs Nacional FC AM	Football	Double	Match Betting		19:00		
23/03/2022	Ceilandia Esporte Clube DF Vs Capital CF DF	Football	Double	Match Betting	£1	19:30	Loss	-£1
24/03/2022	Portugal Vs Turkey	Football	Double	Over/under first half 1.5		20:41		
24/03/2022	Italy Vs North Macedonia	Football	Double	Over/under first half 0.5	£5	20:41	Loss	-£5
24/03/2022	Sweden Vs Czech Republic	Football	Treble	First half result		20:40		
24/03/2022	Italy Vs North Macedonia	Football	Treble	First half result		20:40		
24/03/2022	Portugal Vs Turkey	Football	Treble	First half result	£2	20:40	Loss	-£2
24/03/2022	Italy Vs North Macedonia	Football	ACCA (4)	Over/under first half 0.5		20:43		
24/03/2022	Scotland Vs Poland	Football	ACCA (4)	Over/under first half 0.5		20:43		
24/03/2022	Sweden Vs Czech Republic	Football	ACCA (4)	Over/under first half 0.5		20:43		
24/03/2022	Wales Vs Austria	Football	ACCA (4)	Over/under first half 0.5	£2	20:43	Loss	-£2
24/03/2022	Portugal Vs Turkey	Football	Single	First goal scorer	£1	19:45	Loss	-£1
25/03/2022	Newcastle Jets Vs Sydney FC	Football	Single	Over/under first half 0.5	£15	08:45	Win	£21.67
25/03/2022	Pascoe Vale Vs Langwarrin	Football	Double	Over/under first half 0.5		09:15		
25/03/2022	Adelaide Raiders Vs Modbury Jets	Football	Double	Over/under first half 0.5	£0.67	09:00	Win	£1.98
25/03/2022	Oakleigh Cannons Vs Port Melbourne Sharks	Football	Single	Over/under first half 0.5	£21	09:30	Win	£28.64
25/03/2022	GKS Jastrzebie Vs Podbeskidzie Bielsko-Biala	Football	Double (boosted)	Match Betting		10:15		
25/03/2022	Saraswoti Youth Club Vs Shree Bhagwati Club	Football	Double (boosted)	Match Betting	£0.62	10:00	Loss	-£0.62
25/03/2022	IF Brommapojkarna Vs Orgryte IS	Football	Single	Over/under first half 0.5	£30.00	12:00	Win	£45.00
28/03/2022	Azampur FC Vs Fakirapool Young Men's Club	Football	Single	Over/under first half 0.5	£1.56	13:15	Loss	-£1.56
28/03/2022	France U21 Vs Northern Ireland U21	Football	Single	Over/under first half 1.5	£7	19:45	Loss	-£7
28/03/2022	France U21 Vs Northern Ireland U21	Football	Single	First half result	£3	19:45	Win	£5.18
28/03/2022	Defensores de Belgrano Vs Nueva Chicago	Football	Single	Over/under first half 0.5	£5.18	21:05	Win	£9.07
01/04/2022	Sao Paulo Crystal FC PB Vs Botafogo	Football	Single	Over/under first half 0.5	£7	00:31	Win	£14.35
01/04/2022	Beitar Ramat Gan Vs FC Roei Heshbon Tel Aviv	Football	Single (boosted)	Over/under first half 0.5	£1.35	09:12	Win	£2.16
01/04/2022	AIPA Leichhardt Tigers Vs Wollogong Wolves FC	Football	Single	Over/under first half 1.5	£1.16	09:20	Cashed ou	£0.01
01/04/2022	FC Constantine Women Vs AS Surete Nationale Women	Football	Double	Match Betting		09:25		
01/04/2022	AIPA Leichhardt Tigers Vs Wollogong Wolves FC	Football	Double	Match Betting	£2	09:25	Cashed ou	£2.18
01/04/2022	FC Constantine Women Vs AS Surete Nationale Women	Football	Double	First team to score		09:26		
01/04/2022	AIPA Leichhardt Tigers Vs Wollogong Wolves FC	Football	Double	Next team to score	£2	09:26	Cashed ou	£1.76
01/04/2022	Melbourne Knights Vs Hulme City	Football	Single	Over/under first half 0.5	£10	09:45	Cashed ou	£5.46
01/04/2022	Bentleigh Greens Vs Green Gully Cavaliers	Football	Single	Over/under first half 0.5	£8.84	10:47	Loss	-£8.84
01/04/2022	Bentleigh Greens Vs Green Gully Cavaliers	Football	Single	Over/under first half 0.5	£1.76	10:53	Cashed ou	£2.16
01/04/2022	Croydon Kings FC Vs West Torrens Birkalla	Football	Single	Over/under first half 0.5	£2.16	12:17	Loss	-£2.16
01/04/2022	Milwall U23 Vs Peterborough United U23	Football	Single	Over/under first half 0.5	£15	13:09	Loss	-£15

Appendix 2 Figure 4: Participant 17's screenshotted betting transaction data (transcribed)

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Date	Match	Sport	Bet type	Detail	Stake	Time	Win/Loss	Winnings
18/03/2022	Happy Hour Cheltnam	Horse Racing	Single	-	-	12:48	Win	£45.00
18/03/2022	Happy Hour Cheltnam	Horse Racing	Single	-	-	12:34	Loss	-£10.00
18/03/2022	Happy Hour Cheltnam	Horse Racing	Single	-	-	12:17	Win	£60.00
18/03/2022	-	-	-	-	-	14:26	Win	£0.66
24/03/2022	-	-	-	-	-	23:16	Loss	-
24/03/2022	-	-	-	-	-	23:16	Win	£1.40
25/03/2022	France Vs Ivory Coast	Football	Single	-	-	14:41	Win	£13.50
26/03/2022	England Vs Switzerland	Football	Single	-	£10 (incl free bet)	14:01	Loss	-£10.00
31/03/2022	-	-	-	-	-	14:36	Win	£0.03

Appendix 2 Figure 5: Participant 27's screenshotted betting transaction data (transcribed)

Date	Match	Sport	Bet type	Detail	Stake	Time	Win/Loss	Winnings
21/03/2022	Friends Don't Ask	Horse Racing	Bet boost	To win	£20	15:28	Loss	-£20
21/03/2022	Military Tactic	Horse racing	Single	To win	£20	16:00	Loss	-£20
22/03/2022	Plymouth Argyle Vs Cheltenham	Football	Single	Plymouth Argyle to win & both teams score	£20	21:43	Loss	-£20
22/03/2022	Morning Spirit	Horse racing	Single	To win	£30	14:25	Loss	-£30
24/03/2022	Wales Vs Austria	Football	Bet boost	Wales to win	£30	16:32	Win	£510
25/03/2022	Mostawaa	Horse Racing	Single	To win	£5 (free bet)	13:10	Loss	£0
25/03/2022	UTA Jazz Vs Charlotte Hornets	Basketball	Trebles (bet boost)	UTA Jazz to win				
25/03/2022	DET Pistons Vs Washington Wizards	Basketball	Trebles (bet boost)	DET Pistons to win				
25/03/2022	ALT Hawks Vs Golden State Warriors	Basketball	Trebles (bet boost)	ATL Hawks to win	£50	17:20	Loss	-£50
26/03/2022	Sir Sedric	Horse Racing	Single	To win	£25	17:47	Loss	-£25
27/03/2022	Champagne Court	Horse Racing	Single	To win	£30	14:47	Loss	-£30
28/03/2022	Finest View	Horse racing	Single	To win	£5	13:52	Win	£14
28/03/2022	Blackjack	Online games	Single		£5 (free bet)	19:36	Loss	-£5
29/03/2022	-	-	Single	Draw	£5	21:41	Loss	-£5
30/03/2022	Colombia Vs Venezuela	Football	Single	Colombia to win	£5	02:30	Win	£8.64
30/03/2022	Brazil Vs Bolivia	Football	Single	Brazil to win	£5	02:23	Win	£7.67

Appendix 2 Figure 6: Participant 29's screenshotted betting transaction data (transcribed)

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Date	Match	Sport	Bet type	Detail	Stake	Time	Win/Loss	Winnings
-	Hidden Cargo	Football	Single	To win	£10	-	Win	£21.50
-	-	Football	Single	Draw	£10	-	Loss	-£10
-	-	Football	Single	Draw	£10	-	Loss	-£10
15/03/2022	Jonbon	Racing	Single	To win	£5 (free be	-	Loss	-£10
-	-	Football	Single	Draw	£10	-	Loss	-£10
-	-	Football	Single	Draw	£10	-	Loss	-£10
-	-	Football	Single	Draw	£10	-	Loss	-£10
-	-	Football	Single	Draw	£10	-	Loss	-£10
-	-	Football	Single	Draw	£10	-	Loss	-£10
-	Coventry	Football	Single	To win	£10	-	Loss	-£10
-	-	Football	Single	Draw	£10	-	Loss	-£10
-	-	Football	Single	Draw	£10	-	Loss	-£10
-	-	Football	Single	Draw	£10 (free b	-	Loss	£0
-	Fleetwood	Football	Single	To win	£10	-	Loss	-£10
-	-	Football	Single	Draw	£10	-	Win	£35
-	Cheltenham	Football	Single	To win	£10	-	Win	£20
-	-	Football	Single	Draw	£10 (free b	-	Loss	£0
-	-	Football	Single	Draw	£10	-	Win	£10
-	Hidden Cargo	Racing	Single	To win	£10	-	Win	£40
-	Typewriter	Racing	Single	To win	£10	-	Loss	-£10
-	Bothwell Bridge	Racing	Single	To win	£10	-	Loss	-£10
-	Drish Hero	Racing	Single	To win	£10	-	Win	£40
-	Mr Beaufort	Racing	Single	To win	£10	-	Win	£21
-	-	Football	Single	Draw	£10	-	Loss	-£10
-	-	Football	Single	Draw	£10	-	Loss	-£10
-	-	Football	Single	Draw	£10	-	Loss	-£10
-	-	Football	Single	Draw	£10	-	Loss	-£10
-	-	Football	Single	Draw	£10	-	Loss	-£10
15/03/2022	Jonbon	Racing	Single	To win	£20	12:54	Loss	-£20
16/03/2022	-	Football	Single	Under 1.5 for	£18	08:54	Win	£18
16/03/2022	Capodanno	Racing	Single	To win	£5 (free be	09:44	Loss	£0
16/03/2022	Klassical Dream	Racing	Single	To win	£5 (free be	23:32	Loss	£0
16/03/2022	Alaphillipe	Cycling	Single	To win	£10	23:13	Loss	-£10
16/03/2022	Frero Banbou	Racing	Single	To win	£10	12:37	Loss	-£10
17/03/2022	Rotheram, Chelsea & West Brom	Football	Multiple	All win 90 mins	£10	21:25	Loss	-£10
17/03/2022	Al Bohum Photo		Single		£5 (free be	21:47	Loss	£0
17/03/2022	Rotheram/Chelsea to win & West Brom to draw with Bristol City	Football	Multiple	Draw/win	£10	21:28	Loss	-£10
19/03/2022	West Ham	Football	Single	To win	£5 (free be	11:35	Loss	£0
19/03/2022	-	Sports	Single	-	£6	10:13	Loss	-£6
19/03/2022	-	Sports	Single	-	£6	13:55	Loss	-£6
22/03/2022	Daniil	Tennis	Single	To win	£20	17:14	-	-
23/03/2022	-	Sports	Single	-	£6	17:29	Loss	-£6
24/03/2022	Federico Delbonis Vs Andy Murray	Tennis	Single	Winner	£20	18:32	Loss	-£20
25/03/2022	Exeter, Sheffield Weds and Northampton to win	Football	Multiple	To win	£10	12:41	Win	£80
26/03/2022	Saleymm	Racing	Single	To win	£10	15:15	Loss	-£10
26/03/2022	-	Sports	Single	-	£6	16:26	Win	£33
26/03/2022	Mujtaba	Racing	Single		£5 (free be	15:18	Loss	£0
26/03/2022	Exeter, Sheffield Weds and Hartlepool to win	Football	Multiple	To win	£10	12:43	Loss	-£10
26/03/2022	Exeter/Sheffield Weds to win and Hartlepool to draw with Northampton	Football	Multiple	Win/draw	£10	12:42	Loss	-£10
28/03/2022	England Vs Cote d'Ivoire	Football	Single	-	£10	20:52	Loss	-£10
30/03/2022	-	Sports	Single	-	£6	20:59	Loss	-£6

Appendix 2 Figure 7: Participant 32's screenshotted betting transaction data (transcribed)

Date	Match	Sport	Bet type	Detail	Stake	Time	Win/Loss	Winnings
29/03/2022	England Vs Ivory Coast	Football	Single	England win each half, England have most corners	£0.17	In play	-	-
29/03/2022	England Vs Ivory Coast	Football	Double up boost	Shots on target by specific player	£0.17	In play	-	-
29/03/2022	-	Football	Accumulator	Goalscorers within 90 mins	£0.34	In play	-	-
29/03/2022	Belgium Vs Burkina Faso	Football	Treble	To lead at half time				
29/03/2022	England Vs Ivory Coast	Football	Treble	To lead at half time				
29/03/2022	Republic of Ireland Vs Lithuania	Football	Treble	To lead at half time	£0.10		Win	£0.65
29/03/2022	Manchester City	Football	Single	To win	£1		Win	£1.08
29/03/2022	Portugal Vs North Macedonia	Football	Single	Portugal to win	£5.40		Win	£5.62
29/03/2022	England Vs Ivory Coast	Football	Power price	Headed shots on target by specific player	£0.17		Cashed out	£0.00

Appendix 2 Figure 8: Participant 33's screenshotted betting transaction data (transcribed)

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Date	Deposit	Time
18/03/2022	-£30	23:40
20/03/2022	-£4.60	00:57
20/03/2022	-£2.40	00:57
20/03/2022	-£1	00:57
20/03/2022	£10	00:54
20/03/2022	-£6.80	00:57
25/03/2022	-£90	17:11
30/03/2022	-£12.16	11:31

Appendix 2 Figure 9: Participant 34's screenshotted betting transaction data (transcribed)

Date	Cash in	Cash out	Balance
-	£0.01		£0.01
-		-£1	£0
-		-£2	£1
-		-£2	£3
-	£5		£5
-		-£1	£0
-		-£2	£1
-		-£2	£3
-	£5		£5

Appendix 2 Figure 10: Participant 39's screenshotted betting transaction data (transcribed)

Date	Match	Sport	Bet type	Detail	Stake	Time	Win/Loss	Winnings
21/03/2022	ADO Den Haag Vs SC Telstar	Football	Lay	Correct Score	£3.81	17:44	Win	£79.48
21/03/2022	ADO Den Haag Vs SC Telstar	Football	Lay	Correct Score	£3.81	17:42	Win	£79.48
22/03/2022	Oldham Vs Sutton Utd	Football	Lay	Match outcome	£9.77	16:23	Win	£34.20
27/03/2022	Syria Vs Iraq	Football	Lay	Match outcome	£4.82	20:43	Win	£11.08
27/03/2022	Syria Vs Iraq	Football	Lay	Match outcome	£4.82	20:42	Win	£11.08
27/03/2022	Finland Vs Slovakia	Football	Lay	Match outcome	£5.03	20:35	Win	£14.59
27/03/2022	Finland Vs Slovakia	Football	Lay	Match outcome	£5.03	20:35	Win	£14.59
27/03/2022	Israel Vs Romania	Football	Lay	Match outcome	£5.04	20:34	Win	£13.10
27/03/2022	Israel Vs Romania	Football	Lay	Match outcome	£5.04	20:32	Win	£13.10
27/03/2022	Saudi Arabia Vs Australia	Football	Lay	Match outcome	£4.91	20:40	Loss	-£4.91
27/03/2022	Saudi Arabia Vs Australia	Football	Lay	Match outcome	£4.91	20:39	Loss	-£4.91
27/03/2022	Poland Vs Sweden	Football	Lay	Match outcome	£4.79	21:05	Win	£15.09
27/03/2022	Poland Vs Sweden	Football	Lay	Match outcome	£4.79	21:05	Win	£15.09

Appendix 2 Figure 11: Participant 40's screenshotted betting transaction data (transcribed)

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Date	Match	Sport	Bet type	Detail	Stake	Time	Win/Loss	Winnings
08/03/2022	-	-	Single		£10	19:46	Win	£27.50
09/03/2022	-	-	Single		£5 (free bet)	19:42	Loss	£0
09/03/2022	-	-	Single		£5 (free bet)	19:56	Loss	£0
09/03/2022	-	-	Single		£5 (free bet)	19:59	Win	£42.50
09/03/2022	-	-	Single		£5 (free bet)	20:09	Win	£7.50
21/03/2022	-	-	Single		£5	19:45	Win	£11.90
21/03/2022	-	-	Single		£5	19:49	Loss	-£5
21/03/2022	-	-	Single		£5	19:51	Loss	-£5
22/03/2022	-	-	Single		£5	18:45	Win	£14.85
22/03/2022	-	-	Single		£5	18:46	Loss	-£5
22/03/2022	-	-	Single		£5	18:48	Loss	-£5
23/03/2022	-	-	Single		£5	18:52	Loss	-£5
23/03/2022	-	-	Single		£5	21:56	Loss	-£5
24/03/2022	-	-	Single		£5	20:32	Loss	-£5
24/03/2022	-	-	Single		£5	20:38	Loss	-£5

Appendix 2 Figure 12: Participant 43's screenshotted betting transaction data (transcribed)

Date	Match	Sport	Bet type	Detail	Stake	Time	Win/Loss	Winnings
25/03/2022	Penrith Panthers Vs Newcastle Knights	Rugby (AUS)	Single	Match outcome (PP to win)	£13	21:20	Win	£22.45
25/03/2022	Beatriz Haddad Maia Vs Maria Sakkari	Tennis	Single	Match outcome (MS to win)	£10	20:18	Loss	-£10

Appendix 2 Figure 13: Participant 48's screenshotted betting transaction data (transcribed)

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10.3 Appendix 3: Appendix for Chapter Five

Appendix 3.1: Further Methodological Detail

Question	Response options
Thinking now about gambling on football. How often have you gambled on a football game during the last 12 months? (adapted from HSE 2018 drinking frequency question)	- Every day - Five to six days a week - Three to four days a week - Once a week - Once or twice a month - Once every couple of moths - Once or twice a year - Not at all in the last 12 months *If the participant selects the final option they will not pass screening*
Are you planning on watching any of the World Cup group stage matches between 20th November and 2nd December 2022?	Yes/No *If the participant selects no then they will not pass screening*
Have you ever been treated, or are you currently receiving treatment, for any personal gambling problems?	Yes/No *If the participant selects yes then they will not pass screening*

Appendix 3.1 Table 1: Screening survey questions for the quasi-experimental study in chapter five

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Topic	Measure	Derived from	Wording
Demographics	Age	Health Survey for England (2019)	What was your age at your last birthday or Input D.O.B
	Ethnicity	HSE (2019)	What is your ethnic group?
	Employment	HSE (2019)	Which of these descriptions applies to what you were doing these last 7 days…
	Monthly income	HSE (2019)	Gross monthly income before tax
	Place of residence		Area of residence (NW, SE…)
Gambling			
	What do you gamble on?	HSE (2018)	Have you spent any money on the following activities in the last 12 months (National lottery, scratchcards, football pools, bingo, fruit/slot machines, virtual gaming machines in bookmakers, table games in a casino, poker in a pub tournament/league/club, online gambling games, online betting with a bookmaker on an event/sport, betting on horse races, betting exchange, dog races, sports events in a bookmaker, other events in a bookmaker (or on phone)?
	Number of betting accounts	***Adapted from Hing (2014)***	During the last 12 months, how many accounts did you hold with different betting agencies?
	Preferred operator		List of popular operators with option to type one in
	Bets per week		Open box
	Typical amount staked per week		Open box
	Gambling severity	Problem Gambling Severity Index	Link below
Other	How often do you drink	Audit-C	Link below
	SR mental health	Adapted from Life Satisfaction question in HSE (2018)	Overall, how would you rate your mental health nowadays (0=poor, 10=excellent)
	SR general health	Adapted from Life Satisfaction question in HSE (2018)	Overall, how would you rate your general health nowadays (0=poor, 10=excellent)
	Life satisfaction	HSE (2018)	Overall, how satisfied are you with your life nowadays (0=not at all, 10=completely)
	Measure of social gambling	Piloted in feasibility study	Do you often place bets when you are on your own?

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	Probability question		e.g. Imagine you have a standard coin with heads on one side and tails on the other. What is the probability that you flip the coin twice in a row and get heads both times?

Appendix 3.1 Table 2: Baseline survey questions for the quasi-experimental study in chapter five

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Measure (validity)	Question	Response
Watch or bet on the game	Did you watch the World Cup group stage game live (on television or any portable device) on [INSERT DATE]? Did you place a bet on this game? Please select all which are true. Leave the answer blank if you did not watch the game live, or did not place a bet on the game.	Matrix with the option to select which games that had watched, and which games they had placed a bet on.
Follow the game in other ways	Did you follow the World Cup group stage match on [INSERT DATE] in any other way? Please select all which apply.	None, radio, social media, text feed (e.g. BBC), betting apps, other.
Betting diary (informed by the results of chapter four)	On the next page you will be asked to insert details of all of the football bets you placed yesterday (Sunday 20th November). Please do not input details of other sports or non-sports bets, and please ensure that you input ALL football bets, and not just those related to yesterday's World Cup games. To help, please open your betting accounts and use these as a reference. Please use a 24 hour clock when filling in the timing of your bets, and do not worry about adding too much to "bet detail". [INSERT SCREENSHOTTED EXAMPLE OF BETTING DIARY] Use the plus button (in the red circle) to continue adding bets until you have added all of your football bets. If you did not place any football bets yesterday, please leave the boxes blank and click next.	One open box for bet detail, two boxes for hours (HH) and minutes (MM) of the bet (timing of the bet), one open box for the operator.
Other gambling activities (informed by Health Survey for England)	Other than betting on the World Cup matches, did you take part in any other form of gambling yesterday [INSERT DATE] Please select all which apply	Response options from Health Survey for England (2018): National lottery; scratch cards; other sports with a bookmaker (e.g. rugby, tennis); bingo; fruit machines/slot machines; virtual

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		gaming machines in bookmakers; table games in a casino; poker in a pub/tournament /league/club; online gambling games; football pools; other sports with a bookmaker in person (e.g. rugby, tennis); betting on horse racing (online/in-person; betting exchange/ betting on dog racing; betting on other events in a bookmaker (or on the phone); none.

Appendix 3.1 Table 3: Daily betting survey questions for the quasi-experimental study in chapter five

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Measure (validity)	Question	Response option
Win/lose	Did you win make an overall win on your bets on the World Cup matches over the two days?	Yes/no
Loss chasing (PGSI)	When you gambled on the WC matches, did you go back another day to try to win back any money you had lost? (***adapted from PGSI)***	Yes, No, N/A
Team supporting	Are you supporting a team other than England during this World Cup?	Yes, No I am supporting England
Direct promotions	Did you receive, or use, any offers sent to you directly by gambling operators during the group stages of the World Cup 2022? Please select all which apply. If you did not receive or use a direct promotion, please leave this table blank and click next.	A matrix which allowed respondents to select if they received or used an offer via email, text, social media, or other.
Focus group	Would you be interested in taking part in a Focus Group on **Monday 12th December** between **6pm and 7pm**? The purpose of the focus group is to understand respondent's experiences with the study. For this, you would be reimbursed another £10.	Yes/No
General comments	Do you have any comments or suggestions about this survey?	Open box

Appendix 3.1 Table 4: Follow-up survey questions for the quasi-experimental study in chapter five

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Match Excitement/Interest	ITV	BBC
Determined knock-out	**Ecuador Vs Senegal:** Ecuador lose against Senegal and are knocked out	**Iran Vs USA:** Iran lose against USA and are knocked out
	Japan Vs Spain: Spain knock out Germany on goals scored.	**Wales Vs England:** Wales lose against England and are knocked out
	Costa Rica Vs Germany: Costa Rica knocked out and Germany knocked out on goal difference with Spain.	**France Vs Tunisia:** France win against Tunisia and Tunisia knocked out on goal difference with Australia.
	Serbia Vs Switzerland: Switzerland go through and Serbia knocked out	**Australia Vs Denmark:** Australia go through on goal difference to Tunisia and Denmark are knocked out
	Cameroon vs Brazil: Switzerland win against Serbia and knock out Cameroon.	**Poland Vs Argentina:** Poland go through on goal difference and knock out Mexico
		Saudi Arabia Vs Mexico: Saudi Arabia knocked out and Mexico knocked out on goal difference to Poland.
		Croatia Vs Belgium: A draw between these teams saw Croatia kicked out.
		South Korea Vs Portugal: South Korea kick Uruguay out on goals scored.
		Ghana Vs Uruguay: Ghana lose and are kicked out, Uruguay kicked out on goals scored compared to South Korea.

Appendix 3.1 Table 5: Further details of match characteristics

Sources: BBC https://www.bbc.co.uk/newsround/63832029; BARB https://www.barb.co.uk/viewing-data/most-viewed-programmes/; https://www.barb.co.uk/insight-parent/insight-what-people-watch/what-people-watch-viewing-in-2022/; Sporting News https://www.sportingnews.com/uk/football/news/teams-out-world-cup-2022-list-nations-eliminated-fifa-2022/cmk6aexisveysdxidiq84baf; https://www.sportingnews.com/us/soccer/news/world-cup-standings-2022-table-live-updated-group-qatar/lv5qodvbdsecrwf0gwelqzn0

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	Item No	Recommendation	Checked
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	YES
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	YES (n/a for thesis)
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	YES
Objectives	3	State specific objectives, including any prespecified hypotheses	YES
Methods			
Study design	4	Present key elements of study design early in the paper	YES
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	YES
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	YES
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	YES

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Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	YES
Bias	9	Describe any efforts to address potential sources of bias	YES
Study size	10	Explain how the study size was arrived at	YES
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	YES
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	YES
		(*b*) Describe any methods used to examine subgroups and interactions	YES
		(*c*) Explain how missing data were addressed	YES
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	N/A
		(e) Describe any sensitivity analyses	YES

Results

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	YES
		(b) Give reasons for non-participation at each stage	YES
		(c) Consider use of a flow diagram	YES
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	YES
		(b) Indicate number of participants with missing data for each variable of interest	N/A

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		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	N/A
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	YES
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	N/A
		Cross-sectional study—Report numbers of outcome events or summary measures	N/A
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	YES
		(*b*) Report category boundaries when continuous variables were categorized	YES
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	YES
Discussion			
Key results	18	Summarise key results with reference to study objectives	YES
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	YES
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	YES
Generalisability	21	Discuss the generalisability (external validity) of the study results	YES
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	YES

Appendix 3.1 Table 6: STROBE checklist for observational studies

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Country	FIFA Ranking (OCT 2022)
Brazil	1
Belgium	2
Argentina	3
France	4
England	5
USA	6
Spain	7
Netherlands	8
Portugal	9
Denmark	10
Germany	11
Croatia	12
Mexico	13
Uruguay	14
Switzerland	15
Senegal	18
Wales	19
Iran	20
Serbia	21
Morocco	22
Japan	24
Poland	26
South Korea	28
Tunisia	30
Costa Rica	31
Australia	38
Canada	41
Cameroon	43
Ecuador	44
Qatar	50
Saudi Arabia	51
Ghana	61

Appendix 3.1 Table 7: October 2022 FIFA rankings (for countries in the group stages of the World Cup)

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Appendix 3.2: Preregistered Protocol

Note: Included are both the revised and original protocols. The revised version appears first, with explanations for changes, followed by the original. This protocol was preregistered on the Open Science Framework and is available at: https://osf.io/9uqt3/

BBC vs ITV: How gambling advertising during the World Cup influences football betting

Ellen McGrane

Elizabeth Goyder

Rob Pryce

Matt Field

Luke Wilson

Introduction:

Public health experts in the UK are concerned about the commercial relationship between unhealthy products and live sports (Ireland et al., 2019). Following the liberalisation of advertising laws in the 2005 Gambling Act, there has been rising concern about the impact of gambling advertising. In a market characterised by low product differentiation and inelasticity of price (Lopez-Gonzalez et al., 2017), betting companies compete through intense advertising embedded within live matches, in television advert breaks, and in other direct forms. Football has emerged from a sport loosely connected to gambling to one in which gambling is now culturally embedded into the sport (McGee, 2020; Sharman, 2020). These have been identified as areas of concern requiring further research (PHE 2018; 2021).

Systematic reviews have identified consistent positive associations between exposure to gambling advertising and a range of gambling behaviours both generally (Bouguettaya et al 2020), and in the context of sport (Killick & Griffiths, 2021). A dose-response relationship has also been reported; increasing exposure having an increasing effect on behaviour (Bouguettaya et al 2020). However, a large majority of studies suffer from issues of reverse causality, confounding, and recall bias. There is a gap in the literature for a study which aims to measure the effect of advertising on gambling behaviour in a "real-world" setting.

Natural experiment:

The current study will use a natural experiment to extract the causal effect of television gambling advertising during the 2022 Qatar World Cup on the frequency of *"in-play"* football bets in a sample of men in England. The group-stage matches are spread equally between ITV and BBC; ITV which shows adverts (exposure channel), and BBC which does not (control channel). This setting offers a unique opportunity to isolate the effect of advertising on behaviour by measuring the difference in betting behaviour when game is televised live on ITV compared to BBC.

Methods:

Design:

This research will make use of the exogenous variation in television advertising between ITV and BBC in the World Cup. This natural experiment has a pseudo-randomised setup: the exposure channel (ITV/BBC) is out of the researchers'/individuals' control, but the games have been allocated to ensure an equal split of important (e.g. home nation) games. In this study, ITV will be used as a proxy for advertising exposure to help eliminate the issues of reverse causality and confounding in existing observational studies.

This study will use longitudinal surveys throughout the group stages of the World Cup between 20th November and 2nd December 2022. The baseline survey will ask a number of demographic questions, as well as questions about respondents usual gambling behaviours. The daily surveys will measure the frequency and timing of football bets placed on the 13 group-stage match days, as well as recording their exposure to the live game (i.e. did they watch it).

Participants:

Participants will be recruited using Prolific (https://www.prolific.co/). The inclusion criteria for participants will be:

- Males
- Aged 18-45
- In England
- Who gamble on football (at least once in the previous 12 months)
- Who are planning to watch the group stage World Cup games
- Who have no history of treatment for gambling disorder

Screening:

Prolific will send a screening survey to a pool of potential participants: males, aged 18-45, in England, who report that they watch association football (n=2631). The sample will be restricted to England due to the regional variation in advertising across ITV channels in the UK. The screening survey will ask additional questions, excluding those who have not gambled on football in the previous 12 months, and those who have a history of treatment for gambling disorder for ethical reasons. The final sample will be selected based on those with the highest usual gambling frequency. Oversampling of higher risk gamblers allows us to capture a larger number of these individuals, whom are a vulnerable group in terms of public policy.

Procedure:

Eligible participants will be invited to the study and asked to fill out a baseline questionnaire on the 14th November. Following this, daily surveys in the style of a gambling diary will be sent out each morning following the group stage match days (21st November to 3rd December). Finally, a follow-up survey will be sent out on 5th December.

Live games will be recorded using Box of Broadcasts (https://learningonscreen.ac.uk/ondemand). The recordings will be used to view the occurrence and type of adverts during the programme to confirm whether there are gambling adverts present, and to count the frequency of gambling adverts around each game televised on ITV.

Research questions:

RQ1: Are there a higher number of "in-play" football bets placed when a live game is televised on ITV (adverts) compared to BBC (no adverts)?

RQ2: Is there a dose-response effect - does a higher frequency of gambling advertising have an increasing effect on the number of in-play football bets placed?

The first of these research questions will use the pseudo-randomised, natural experiment setting. The second research question is additional exploratory work.

Analysis:

Variables:

***Updates to protocol:** The bets will be labelled as "in-play" and not "impulsive". This research will also now test a 60 minute window as an additional part of the sensitivity analysis.*

Stern (1962) argues that decisions can be made on impulse, and may be driven by external stimuli such as mass advertising: a key factor in encouraging consumer buying. Hing et al (2018) define impulsive sports betting as unplanned and spontaneous betting without consideration of why the bet should be placed, or of its likely outcomes (Hing et al., 2018). This type of betting has been reported to be more common in those with a higher PGSI score (Hing et al., 2018). For this study, betting has been defined as "in-play" or not. An "in-play" bet is defined as occurring within the window of a match programme. However, it does not need to refer to a bet placed on the specific match watched. Bets placed within the window of the live programme are important for this study as they are the most likely type of betting to be influenced by television advertising. Advertising has been shown to increase betting (Bouguettaya et al., 2019; Killick & Griffiths., 2021), and trigger relapse in those with gambling disorder (Griffiths, 2005; Binde, 2009). Betting in the days, or hours, before the match is not likely to be associated with television advertising during the live programme.

In their study, Hing et al., (2018) leave it to the participants discretion to report their bet as "impulsive". In the current study, "in-play" bets will be defined using different windows around the game, in line with the "whistle-to-whistle" industry advertising policy in the UK. The policy defines the window as including the 5 minutes prior to the first whistle, the duration of the match, and 5 minutes at the end following the final whistle. This study will define different windows using 10, 15, 30 and 60 minutes to test whether changing these windows impact results. Figure 1 shows the current "whistle-to-whistle" policy window, and the three alternative windows being tested in this study.

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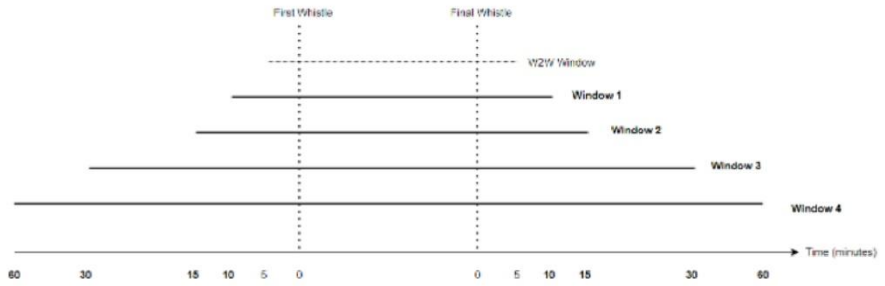

Figure 1: In-play bet windows

Table 1: Variables for the analysis

Variable		Description
Dependent variable	1) Frequency of in-play bets	1) The number of bets which occur in the "in-play" window around a game (using the windows defined above)
Independent variables (main)	1) ITV dummy variable 2) Watch variable 3) Number of adverts around the live ITV game	1) This will equal 1 if the game is televised on ITV 2) This will equal 1 if the respondent reports that they watched the game live 3) The number of adverts occurring over the duration of the TV programme
Other independent variables	1) Day of the match 2) Time of the match 3) Home nation game 4) Match interest	1) Binary (weekday vs weekend) 2) Binary (matches televised before 7pm are classified as daytime) 3) Binary (England or not) 4) Measured using match viewing figures, and the (absolute) difference between the FIFA rankings of the two countries playing the match

Statistical Analyses:

***Updates to protocol:** Due to issues with sample size and potential selection effects with the "watch" variable, this analysis will be undertaken as originally planned in the Confirmation Review document. ITV will be used as a proxy for advertising exposure. The main effect of interest will be the coefficient on this variable. Due to a low number of observations, the*

analysis looking at the differences between watching at home/in the pub will not be undertaken.

The current study will produce a panel data set at the individual (n=400), and match (n=48) level. The planned analyses are described below in relation to the research questions:

RQ1a: Do individuals place a higher frequency of in-play football bets when exposed to a channel showing gambling advertising (ITV) compared to one that shows no advertising (BBC)?

This analysis will use a panel data regression model to estimate the effect of watching a live game which occurs on ITV: the main effect of interest being the coefficient on the ITV variable. The hypotheses are detailed below:

> *H1: There will be a positive effect of the game being on ITV on the number of in-play bets placed*
>
> *H2: There will be a positive effect of watching the game live on the number of in-play bets placed*

RQ2: Does exposure to a higher frequency of gambling advertising have an increasing effect on the number of in-play football bets placed – is there a dose-response relationship?

This analysis will be the same as above, with the binary ITV variable being replaced by a continuous advertising frequency variable which represents the number of adverts present on the live match programme. The effect will now vary by the number of adverts present during the live game. This analysis will also include a variable measuring the number of other adverts in the match programme. The hypothesis associated with this analysis will be:

> *H3: Games with a higher frequency of gambling advertising will have a greater positive effect on the number of in-play football bets placed (i.e. a dose-response relationship exists)*
>
> *H4: The number of other adverts in the match programme will have no impact on the number of in-play bets placed*

References:

Binde, P. (2009). Exploring the impact of gambling advertising: An interview study of problem gamblers. *International journal of mental health and addiction.* **7**(4), pp.541-554.

Bouguettaya, A., Lynott, D., Carter, A., Zerhouni, O., Meyer, S., Ladegaard, I., Gardner, J. and O'Brien, K.S. (2020). The relationship between gambling advertising and gambling attitudes, intentions and behaviours: a critical and meta -analytic review. *Current Opinion in Behavioral Sciences.* **31**, pp.89-101.

Griffiths, M. (2005). Does Gambling Advertising Contribute to Problem Gambling? *eCommunity: International Journal of Mental Health & Addiction.* **3**, pp.15-25.

Hing, N., Russell, A.M.T., Li, E. and Vitartas, P. (2018). Does the uptake of wagering inducements predict impulse betting on sport? *Journal of Behavioral Addictions.* **7**(1), pp.146-157.

Ireland, R., Bunn, C., Reith, G., Philpott, M., Capewell, S., Boyland, E. and Chambers, S. (2019). Commercial determinants of health: Advertising of alcohol and unhealthy foods during sporting events. *Bull World Health Organ.* **97**(4), pp.290-295.

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Sharman, S., Ferreira, C.A. and Newall, P.W.S. (2020). Exposure to Gambling and Alcohol Marketing in Soccer Matchday Programmes. *Journal of Gambling Studies.* **36**(3), pp.979-988.

Stern, H. (1962). The Significance of Impulse Buying Today. Journal of Marketing, **26**(2), 59–62. https://doi.org/10.1177/002224296202600212

The impact of television gambling advertising on the frequency of impulsive football bets placed during the 2022 Qatar World Cup

Ellen McGrane

Elizabeth Goyder

Rob Pryce

Matt Field

Introduction:

Public health experts in the UK remain concerned about the commercial relationship between unhealthy products and live sports (Ireland et al., 2019). Following the liberalisation of advertising laws in the 2005 Gambling Act, there has been rising concern about the impact of gambling advertising. In a market characterised by low product differentiation and inelasticity of price (Lopez-Gonzalez et al., 2017), betting companies compete through intense advertising embedded within live matches, in television advert breaks, and in other direct forms. Football has emerged from a sport loosely connected to gambling to one in which gambling is now culturally embedded into the sport (McGee, 2020; Sharman, 2020). These have been identified as areas of concern requiring further research (PHE 2018; 2021).

Systematic reviews have identified consistent positive associations between exposure to gambling advertising and a range of gambling behaviours both generally (Bouguettaya et al 2020), and in the context of sport (Killick & Griffiths, 2021). A dose-response relationship has also been reported; increasing exposure having an increasing effect on behaviour (Bouguettaya et al 2020). However, a large majority of studies suffer from issues of reverse causality, confounding, and recall bias. There is a gap in the literature for a study which aims to measure the effect of advertising on gambling behaviour in a "real-world" setting.

Natural experiment:

The current study will use a natural experiment to extract the causal effect of television gambling advertising during the 2022 Qatar World Cup on the frequency of *impulsive* football bets in a sample of men in England. The group-stage matches are spread equally between ITV and BBC; ITV which shows adverts (exposure channel), and BBC which does not (control channel). This setting offers a unique opportunity to isolate the effect of advertising on behaviour by measuring the difference in betting behaviour when an individual is exposed to a live game televised on ITV compared to BBC.

Research questions:

RQ1a: Do individuals place a higher frequency of impulsive football bets when exposed to a channel showing gambling advertising (ITV) compared to one that shows no advertising (BBC)?

RQ1b: How does this relationship vary based on the location of exposure (at home or in the pub)?

RQ2: Does exposure to a higher frequency of gambling advertising have an increasing effect on the number of impulsive football bets placed – is there a dose-response relationship?

Methods:

Design:

This study will use longitudinal surveys throughout the group stages of the World Cup between 20th November and 2nd December 2022. The baseline survey will ask a number of demographic questions, as well as questions about respondents usual gambling behaviours. The daily surveys will measure the frequency and timing of football bets placed on the 13 group-stage match days, as well as recording their exposure to the live game (i.e. did they watch it).

Participants:

Participants will be recruited using Prolific (https://www.prolific.co/). The inclusion criteria for participants will be:

- Males
- Aged 18-45
- In England
- Who gamble on football (at least once in the previous 12 months)
- Who are planning to watch the group stage World Cup games
- Who have no history of treatment for gambling disorder

Screening:

Prolific will send a screening survey to a pool of potential participants: males, aged 18-45, in England, who report that they watch association football (n=2631). The sample will be restricted to England due to the regional variation in advertising across ITV channels in the UK. The screening survey will ask additional questions, excluding those who have not gambled on football in the previous 12 months, and those who have a history of treatment for gambling disorder for ethical reasons. The final sample will be selected based on those with the highest usual gambling frequency. Oversampling of higher risk gamblers allows us to capture a larger number of these individuals, whom are a vulnerable group in terms of public policy.

Procedure:

Eligible participants will be invited to the study and asked to fill out a baseline questionnaire on the 14th November. Following this, daily surveys in the style of a gambling diary will be sent out each morning following the group stage match days (21st November to 3rd December). Finally, a follow-up survey will be sent out on 5th December.

Live games will be recorded using Box of Broadcasts (https://learningonscreen.ac.uk/ondemand). The recordings will be used to view the occurrence and type of adverts during the programme to confirm whether there are gambling adverts present, and to count the frequency of gambling adverts around each game televised on ITV.

Analyses:

Variables:

The frequency of bets will be classified into *"impulsive"* and *"not impulsive"*. Stern (1962) argues that decisions can be made on impulse, and may be driven by external stimuli such as mass advertising: a key factor in encouraging consumer buying. Hing et al (2018) define impulsive sports betting as unplanned and spontaneous betting without consideration of why the bet should be placed, or of its likely outcomes (Hing et al., 2018). This type of betting has been reported to be more common in those with a higher PGSI score (Hing et al., 2018). Betting impulsively is important for this study as it is the most likely type of betting to be influenced by television advertising. Advertising has been shown to increase betting (Bouguettaya et al., 2019; Killick & Griffiths., 2021), and trigger relapse in those with gambling disorder (Griffiths, 2005; Binde, 2009). Betting in the days, or hours, before the match is not likely to be associated with the television advertising on ITV during the live programme.

In their study, Hing et al., (2018) leave it to the participants discretion to report their bet as impulsive. In the current study, impulsive bets will be defined using different windows around the game, in line with the "whistle-to-whistle" industry advertising policy in the UK. The policy defines the window as including the 5 minutes prior to the first whistle, the duration of the match, and 5 minutes at the end following the final whistle. This study will

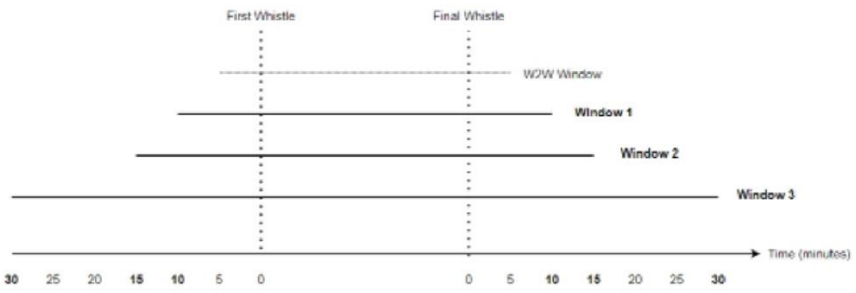

Figure 1: Impulsive bet windows

define different windows using 10, 15 and 30 minutes to test whether changing these windows impact results. Figure 1 shows the current "whistle-to-whistle" policy window, and the three alternative windows being tested in this study.

The variables of interest to this study are listed in the table below:

Table 1: Variables for the analysis

Variable		Description
Dependent variable	1) Frequency of *impulsive* bets	1) The number of bets which occur in the "*impulsive*" window around a game (using the windows defined above)
Independent variables (main)	1) ITV dummy variable 2) Watch variable 3) Number of adverts around the live ITV game 4) ITV*Watch interaction 5) NumAdverts*Watch interaction	1) This will equal 1 if the game is televised on ITV 2) This will equal 1 if the respondent reports that they watched the game live (this will be split into watched at home vs the pub for RQ1a) 3) The number of adverts occurring over the duration of the TV programme 4) The interaction term between watching the live game, and the live game occurring on ITV (main effect) 5) The interaction term between watching the live game and the number of adverts on the live match programme (testing the dose-response effect)
Other independent variables	1) Day of the match 2) Time of the match 3) Home nation game 4) Match interest	1) Binary (weekday vs weekend) 2) Binary (matches televised before 7pm are classified as daytime) 3) Binary (England or not) 4) Measured using match viewing figures

Statistical Analyses:

The current study will produce a panel data set at the individual (n=400), and match (n=48) level. The planned analyses are described below in relation to the research questions:

RQ1a: Do individuals place a higher frequency of impulsive football bets when exposed to a channel showing gambling advertising (ITV) compared to one that shows no advertising (BBC)?

This analysis will use a panel data regression model to estimate the effect of watching a live game which occurs on ITV: the main effect of interest being the interaction term between ITV and whether the individual watched the match. The hypotheses are detailed below:

> *H1: There will be no effect of a game being televised on ITV on the number of impulsive bets placed*
>
> *H2: There will be a positive effect of watching the game live on the number of impulsive bets placed*
>
> *H3: There will be a positive effect of watching the game live, and on ITV, on the number of impulsive bets placed*

RQ1b: How does this relationship vary based on where people watch the live games (at home or in the pub)?

The analysis will be the same as above, with the effect now varying by location of exposure. The "watch" variable will be split into watching at home and watching at the pub. The additional hypothesis will be:

> *H4: There will be a smaller positive effect of watching the game live on ITV in a pub, compared to watching it live on ITV at home, on the number of impulsive bets placed*

RQ2: Does exposure to a higher frequency of gambling advertising have an increasing effect on the number of impulsive football bets placed – is there a dose-response relationship?

This analysis will be the same as above, with the binary ITV variable being replaced by a continuous advertising frequency variable which represents the number of adverts present on the live match programme. The effect will now vary by the number of adverts present during the live game. The hypothesis associated with this analysis will be:

> *H5: Games with a higher frequency of gambling advertising will have a greater positive effect on the number of impulsive football bets placed (i.e. a dose-response relationship exists)*

References:

Binde, P. (2009). Exploring the impact of gambling advertising: An interview study of problem gamblers. *International journal of mental health and addiction.* **7**(4), pp.541-554.

Bouguettaya, A., Lynott, D., Carter, A., Zerhouni, O., Meyer, S., Ladegaard, I., Gardner, J. and O'Brien, K.S. (2020). The relationship between gambling advertising and gambling attitudes, intentions and behaviours: a critical and meta -analytic review. *Current Opinion in Behavioral Sciences.* **31**, pp.89-101.

Griffiths, M. (2005). Does Gambling Advertising Contribute to Problem Gambling? *eCommunity: International Journal of Mental Health & Addiction.* **3**, pp.15-25.

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`

Appendix 3.3: Supplementary Analysis

Model	Window			
	60=30=15=10	*60=30*	*30=15*	*15=10*
	p-value			
Poisson	0.3678	0.957	0.127	0.183
Logit	0.0740	0.217	0.088	0.091

Appendix 3.3 Table 1: Testing for differences in the magnitude of effect between different windows around the live game

Note: Null hypothesis of equality of effect size between the referenced windows (60-minute, 30-minute, 15-minute, 10-minute)

Model	Dependent Variable	60-minute	30-minute	15-minute	10-minute
Poisson	Freq Gambling Ads (n)	1.00	1.12**	0.92**	0.89*
		[0.92,1.09]	[1.01,1.25]	[0.85,0.98]	[0.78,1.01]
Poisson	Gambling Advert (0,1)	1.16***	1.16***	1.19***	1.05
		[1.07,1.25]	[1.05,1.29]	[1.06,1.34]	[0.92,1.19]
Logistic	Freq Gambling Ads (n)	0.94	1.18***	0.94	0.96
		[0.82,1.07]	[1.05,1.33]	[0.87,1.02]	[0.82,1.12]
Logistic	Gambling Advert (0,1)	1.22***	1.26***	1.31***	1.16**
		[1.13,1.32]	[1.15,1.37]	[1.19,1.44]	[1.02,1.31]

Appendix 3.3 Table 2: Tables 14 and 17 from the main thesis (dose-response models) excluding safer gambling advertisements from the primary explanatory variable

*Note: 'Freq Gambling Ads' is a count of the frequency of gambling advertisements on television present during the specified window excluding safer gambling advertisements; 'Gambling Advert' is a binary variable representing whether there is at least one gambling advertisement present in the specified window, excluding any safer gambling advertisements; Poisson models report Incidence Rate Ratios (IRR) that show the change in the frequency of football betting associated with the dependent variable; Logistic models report Odds Ratios (OR) that show the probability of placing a football bet in response to the dependent variable; Poisson models report robust standard errors; All models include the same control variables as the models reported in the main thesis; Confidence intervals in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$*

`

Model	Characteristic	Subgroup	n	60-minute	30-minute	15-minute	10-minute
Poisson	Income	£0 - £19,999	46	1.10	0.93	0.95	1.07
ITV				[0.88,1.38]	[0.74,1.17]	[0.76,1.20]	[0.75,1.53]
		£20,000 - £39,999	199	1.15**	1.12	1.16	1.14
				[1.02,1.29]	[0.95,1.31]	[0.94,1.43]	[0.92,1.41]
		£40,000 - £59,999	100	1.22***	1.42***	1.55***	1.66***
				[1.08,1.37]	[1.19,1.70]	[1.30,1.86]	[1.35,2.03]
		£60,000+	51	1.12	1.02	1.03	1.04
				[0.93,1.34]	[0.80,1.30]	[0.77,1.38]	[0.77,1.40]
	Mental Health	Very good/good	260	1.18***	1.20***	1.23**	1.25**
				[1.08,1.30]	[1.05,1.36]	[1.04,1.45]	[1.04,1.51]
		Fair/bad	136	1.10	1.09	1.22**	1.22**
				[0.97,1.24]	[0.92,1.28]	[1.01,1.46]	[1.01,1.46]
	Risk level	PGSI>=3	157	1.09	1.09	1.12	1.12
				[0.97,1.23]	[0.94,1.26]	[0.97,1.29]	[0.96,1.30]

`

		PGSI<3	239	1.19***	1.21***	1.27**	1.32**
				[1.08,1.31]	[1.05,1.39]	[1.05,1.54]	[1.06,1.64]
	Age	<=30	141	1.07	1.12	1.25***	1.28***
				[0.96,1.19]	[0.97,1.31]	[1.06,1.46]	[1.08,1.51]
		>30	255	1.20***	1.18**	1.20**	1.22**
				[1.09,1.32]	[1.04,1.35]	[1.02,1.42]	[1.01,1.47]
Logistic	Income	£0 - £19,999	46	0.93	0.93	1.01	1.11
ITV				[0.74,1.16]	[0.73,1.18]	[0.77,1.32]	[0.84,1.47]
		£20,000 - £39,999	199	1.31***	1.29***	1.39***	1.39***
				[1.17,1.47]	[1.14,1.47]	[1.21,1.60]	[1.20,1.61]
		£40,000 - £59,999	100	1.32***	1.61***	1.57***	1.61***
				[1.12,1.55]	[1.35,1.91]	[1.30,1.89]	[1.32,1.95]
		£60,000+	51	1.09	0.96	0.97	0.96
				[0.88,1.36]	[0.75,1.23]	[0.75,1.26]	[0.73,1.26]
	Mental Health	Very good/good	260	1.28***	1.32***	1.35***	1.36***

`

				[1.16,1.41]	[1.19,1.48]	[1.20,1.52]	[1.20,1.53]
		Fair/bad	136	1.13*	1.14*	1.23**	1.28***
				[0.98,1.29]	[0.98,1.32]	[1.04,1.46]	[1.08,1.53]
	Risk level	PGSI>=3	157	1.20***	1.19**	1.17**	1.17**
				[1.06,1.36]	[1.03,1.36]	[1.01,1.36]	[1.00,1.37]
		PGSI<3	239	1.24***	1.31***	1.42***	1.46***
				[1.11,1.37]	[1.17,1.47]	[1.25,1.60]	[1.28,1.66]
	Age	<=30	141	1.20**	1.21**	1.35***	1.39***
				[1.04,1.38]	[1.04,1.41]	[1.14,1.60]	[1.16,1.65]
		>30	255	1.23***	1.28***	1.29***	1.30***
				[1.12,1.36]	[1.15,1.43]	[1.15,1.45]	[1.16,1.47]

Appendix 3.3 Table 3: Subgroup analysis for Tables 13 and 16 from the main thesis (ITV models)

*Note: The key explanatory variable is a binary variable for the broadcaster (1 "ITV" 0 "BBC"); Coefficients for Poisson models are Incidence Rate Ratios (IRR) showing the change in the frequency of football bets placed 'during the game'; Coefficients for Logistic models are Odds Ratios (OR) showing changes in the probability of placing a football bet 'during the game'; Poisson models use robust standard errors; All models include the same control variables as the models reported in the main thesis; Confidence intervals in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; 'PGSI' Problem Gambling Severity Index; PGSI>=3 is equal to moderate to high risk of gambling-related harm.*

`

Model	Dependent Variable	60-minute T=5	30-minute T=4	15-minute T=2	10-minute T=0
Poisson	Low threshold	**1.54*****	**1.16*****	0.99	-
		[1.17,2.03]	**[1.05,1.28]**	[0.89,1.10]	-
	High threshold	**7.37*****	**1.59****	0.88*	0.89
		[1.93,28.06]	**[1.04,2.43]**	[0.77,1.01]	[0.74,1.06]
Logistic	Low threshold	**1.73****	**1.28*****	1.04	1.00
		[1.13,2.65]	**[1.10,1.48]**	[0.91,1.19]	[1.00,1.00]
	High threshold	**12.79****	**2.24*****	0.90	0.93
		[1.57,104.30]	**[1.24,4.04]**	[0.76,1.06]	[0.78,1.11]

Appendix 3.3 Table 4: Threshold models for Tables 14 and 17 from the main thesis (dose-response models)

Note: T=threshold number of adverts; Coefficients for Poisson models are Incidence Rate Ratios (IRR) showing the change in the frequency of football bets placed 'during the game'; Coefficients for Logistic models are Odds Ratios (OR) showing changes in the probability of placing a football bet 'during the game'; Poisson models use robust standard errors; All models include the same control variables as the models reported in the main thesis; Confidence intervals in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01

Model	Dependent Variable	60-minute	30-minute	15-minute	10-minute
Poisson	Freq Gambling Ads (n)	0.96	1.05	0.93**	0.89
		[0.88,1.04]	[0.97,1.15]	[0.87,1.00]	[0.74,1.06]
Logistic	Freq Gambling Ads (n)	0.98	1.10*	0.93	0.93
		[0.85,1.13]	[0.99,1.23]	[0.85,1.02]	[0.78,1.11]

Appendix 3.3 Table 5: Tables 14 and 17 from the main thesis (dose-response models) with the sample restricted to ITV games only

Note: The key explanatory variable is a count of the number of television gambling advertisements present during the specified window; Poisson coefficients are Incidence Rate Ratios (IRR) showing the change in the frequency of football bets placed 'during the game'; Poisson models use robust standard errors; Logistic coefficients are Odds Ratios (OR) showing changes in the probability of placing a football bet 'during the game'; All models include the same control variables as the models reported in the main thesis; Confidence Intervals in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01

`

Model	Dependent Variable	60-minute	30-minute	15-minute	10-minute
Poisson	ITV	1.15***	1.16***	1.21***	1.21***
		[1.06,1.25]	[1.04,1.30]	[1.06,1.38]	[1.05,1.40]
	Freq Gambling Ads (n)	0.92*	1.14**	0.98	0.92
		[0.84,1.01]	[1.01,1.28]	[0.88,1.08]	[0.73,1.15]
	Gambling Advert (0,1)	1.15***	1.16***	1.21***	1.11*
		[1.06,1.25]	[1.04,1.30]	[1.07,1.38]	[0.98,1.25]
Logistic	ITV	1.20***	1.26***	1.31***	1.31***
		[1.08,1.34]	[1.13,1.42]	[1.15,1.49]	[1.14,1.49]
	Freq Gambling Ads (n)	0.90	1.19**	0.97	0.97
		[0.76,1.05]	[1.04,1.37]	[0.88,1.07]	[0.79,1.20]
	Gambling Advert (0,1)	1.20***	1.26***	1.34***	1.16**
		[1.08,1.34]	[1.13,1.42]	[1.18,1.52]	[1.00,1.34]

Appendix 3.3 Table 6: Tables 13 and 16 from the main thesis (ITV models) with the sample restricted to those reporting watching the games.

*Note: 'ITV' represents the broadcaster (1 "ITV" 0 "BBC"); 'Freq Gambling Ads' is a count of the frequency of gambling advertisements on television present during the specified window; 'Gambling Advert' is a binary variable representing whether there is at least one gambling advertisement present in the specified window, Poisson coefficients are Incidence Rate Ratios (IRR) showing the change in the frequency of football bets placed 'during the game'; Poisson models use robust standard errors; Logistic coefficients are Odds Ratios (OR) showing changes in the probability of placing a football bet 'during the game'; All models include the same control variables as the models reported in the main thesis; Confidence Intervals in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$*

`

10.4 Appendix 4: Appendix for Chapter Seven

Appendix A Table 1: Data Specification

Specification	**Concise Media Co (1)**	**TVSportsGuide (2)**	**Nielsen Media Ltd (3)**
Date	✓	✓	✓
Start time of the programme	✓		
End time of the programme	✓		
Kick-off time for the live game		✓	
Time of the advert			✓
Holding company			✓
Advertiser			✓
Channel	✓	✓	✓
Programme name	✓	✓	✓
Programme genre	✓		✓
Subgenre (including type of sport)		✓	✓
Sports League		✓	

`

Appendix B: 'RSelenium' Code for Scraping Kickoff Data

```
################################################################################
##############################LOAD PACKAGES#####################################
#load relevant packages
library(RSelenium)
library(tidyverse)
library(rvest)
library(writexl)
library(dplyr)
################################################################################
########################SELENIUM DRIVER SETUP###################################
#set up selenium driver
rD <- rsDriver(browser="firefox", port=12246L, verbose=F)
remDr <- rD[["client"]]
baseurl <- ("https://www.tvsportguide.com/archive/")
################################################################################
##############################FUNCTIONS#########################################
# Create a list of dates for the periods required - YYYY-MM-DD
#1st Sept to 1st Dec 2018 and 2019
date_seq <- c(seq(from = as.Date("2018-09-01"), to = as.Date("2018-12-01"), by = "days"),
        seq(from = as.Date("2019-09-01"), to = as.Date("2019-12-01"), by = "days"))

#empty dataframe for elements
elements_df <- data.frame(Date = character(0),
                  Time = character(0),
                  Title = character(0),
                  Sport = character(0),
                  League = character(0),
                  Channel1 = character(0),
                  Channel2 = character(0),
                  Channel3 = character(0),
```

```
                Channel4 = character(0))


#function to scrape data (by element)
data_scrape <- function (date){

 #some matches have "hidden times" and show the score instead of time on screen. Need time data (find hidden time text).
 time <- matchlist[[n]]$findChildElement(using = "tag name", value = "time")
 Time <-as.character(time$getElementText())

 is_time <- grepl(":", Time)

 if (is_time == FALSE){
  hiddentime<- matchlist[[n]]$findChildElement(using = "class", value = "hidden-time")
  Time <- as.character(hiddentime$getElementAttribute("textContent"))
 }
 if (is_time == TRUE) {
  Time <- as.character(time$getElementText())
 }

 #match title
 title <- matchlist[[n]]$findChildElement(using = "tag name", value = "h3")
 Title <- as.character(title$getElementText())

 #sport
 sport <- matchlist[[n]]$findChildElement(using = "class", value = "sicon")
 Sport<- as.character(sport$getElementAttribute("Title"))

 #league (some do not have a league so skip if empty)
 league <- matchlist[[n]]$findChildElements(using = "class", value = "league")
 if (length(league) != 0) {
  league <- matchlist[[n]]$findChildElement(using = "class", value = "league")
```

```
  League <- as.character(league$getElementText())
}

if (length(league) == 0) {
  League <- ""
}

#channels
Channel1 <- NA
Channel2 <- NA
Channel3 <- NA
Channel4 <- NA

channels <- channellist[[n]]$findChildElements(using = "tag name", value = "a")

for(n in 1:length(channels)){
  if (length(channels) == 0) {
    Channel1 <- NA
  }
  if (length(channels) != 0) {
    assign(paste("Channel", n, sep=""), as.character(channels[[n]]$getElementAttribute("title")))
  }
}

#current date (in the loop)
Date <- as.character(format(date_seq[i], format="%Y/%m/%d"))

#dataframe
df <- data.frame(Date = Date,
                 Time = Time,
                 Title = Title,
                 Sport = Sport,
                 League = League,
```

```
`

            Channel1 = Channel1,

            Channel2 = Channel2,

            Channel3 = Channel3,

            Channel4 = Channel4)

 return(df)

}

################################################################################

##############################DATA SCRAPE LOOP#################################

#loop round dates and matches

for (i in 1:(length(date_seq))) {

 url <- paste0(baseurl, (gsub("/0", "/", format(date_seq[i], format="/%Y/%m/%d"))))

 remDr$navigate(url)

 matchlist<- remDr$findElements(using="class", value="match")

 for (n in 1:length(matchlist)) {

  channellist <- remDr$findElements(using="class", value="channels")

  elements_df <- rbind(elements_df, data_scrape(date_seq[i]))

 }

}

#close selenium server

remDr$close()

rD$server$stop()

################################################################################

##########################EDIT AND SAVE DATASET#################################

#reorder columns

elements_df[,c("Date", "Time", "Title", "Sport", "League", "Channel1", "Channel2", "Channel3",
"Channel4")]
```

`

#fill in missing values with 0 (only for league - channels already assigned NA)

```
elements_df[elements_df == ""] <- 0
```

#duplicate rows 4 times

```
full_data_mod <- elements_df %>%
  expand_grid(Channel = c("Channel1", "Channel2", "Channel3", "Channel4"))
```

#replace NA with missing (to allow the following loop to run)

```
full_data_mod[is.na(full_data_mod)] <- ""
```

#fill in the value of channel for each row

```
for( i in 1:nrow(full_data_mod)){
  if(full_data_mod$Channel[i]=="Channel1") {
    full_data_mod$Channel[i] <- full_data_mod$Channel1[i]
  }
  if(full_data_mod$Channel[i]=="Channel2") {
    full_data_mod$Channel[i] <- full_data_mod$Channel2[i]
  }
  if(full_data_mod$Channel[i]=="Channel3") {
    full_data_mod$Channel[i] <- full_data_mod$Channel3[i]
  }
  if(full_data_mod$Channel[i]=="Channel4") {
    full_data_mod$Channel[i] <- full_data_mod$Channel4[i]
  }
}
```

#drop unwanted channel columns

```
clean_data <- subset(full_data_mod, select = -6:-9)
```

#assign missing values <- NA again

```
clean_data[clean_data == ""] <- NA
```

#drop unwanted rows (each match has 4 rows but not all matches have 4 channels)

`

#now have a row for each match (duplicated for each additional channel it is shown on)

final_data <- drop_na(clean_data)

`

Appendix C: Alternative Regression Model Results

Appendix C Table 1: Linear Regression Results

	Pre-game	5-minutes before	Half-time	Post-game	Total Programme
Post-ban (2019)	**0.35*** [0.10,0.60]**	**-0.39*** [-0.45,-0.34]**	**-2.24*** [-2.38,-2.10]**	**0.01 [-0.20,0.22]**	**-2.31*** [-2.77,-1.86]**
ITV (comparator)					
Sky	0.38 [-0.83,1.59]	-0.17 [-0.48,0.14]	0.41 [-0.37,1.20]	0.63 [-0.56,1.82]	1.09 [-1.48,3.66]
TNT Sports	-0.68 [-1.90,0.54]	-0.35** [-0.66,-0.04]	-0.58 [-1.37,0.21]	-0.79 [-1.98,0.41]	-2.78** [-5.36,-0.20]
Other	-1.77*** [-3.07,-0.47]	-0.44*** [-0.76,-0.12]	-0.65 [-1.45,0.14]	-1.34** [-2.55,-0.14]	-4.35*** [-6.96,-1.74]
Sunday (comparator)					
Monday	1.72*** [1.11,2.32]	-0.07 [-0.20,0.05]	0.17 [-0.14,0.49]	0.90*** [0.42,1.37]	1.83*** [0.80,2.86]
Tuesday	0.72*** [0.21,1.23]	-0.07 [-0.18,0.03]	-0.13 [-0.40,0.14]	0.19 [-0.22,0.60]	0.34 [-0.54,1.22]
Wednesday	1.16*** [0.61,1.71]	0.04 [-0.07,0.15]	-0.12 [-0.40,0.16]	0.52** [0.10,0.94]	1.00** [0.09,1.91]
Thursday	0.50* [-0.05,1.04]	-0.20*** [-0.31,-0.09]	-0.11 [-0.39,0.17]	0.47** [0.05,0.90]	0.23 [-0.68,1.15]
Friday	0.78*** [0.26,1.31]	0.10* [-0.01,0.20]	-0.17 [-0.45,0.10]	0.15 [-0.26,0.57]	0.43 [-0.46,1.31]
Saturday	0.13 [-0.27,0.53]	0.12*** [0.04,0.20]	-0.12 [-0.33,0.08]	0.50*** [0.18,0.81]	0.66* [-0.01,1.34]
Midday (comparator)					
Early afternoon	-0.28 [-0.78,0.23]	0.04 [-0.06,0.13]	-0.17 [-0.42,0.07]	0.18 [-0.19,0.55]	0.13 [-0.68,0.93]
Early evening	-1.06*** [-1.50,-0.62]	-0.03 [-0.12,0.05]	-0.14 [-0.36,0.07]	0.07 [-0.26,0.41]	-0.34 [-1.06,0.38]
Late evening	-1.06*** [-1.53,-0.58]	0.00 [-0.08,0.09]	0.06 [-0.16,0.28]	0.81*** [0.48,1.15]	0.82** [0.10,1.53]
Constant	2.17*** [0.88,3.46]	0.73*** [0.41,1.05]	2.77*** [1.96,3.58]	0.69 [-0.54,1.93]	5.76*** [3.09,8.42]
Observations	736	1049	1042	1042	1045

`

Models report unstandardised coefficients; 95% confidence intervals in bracket; Midday (up to 12:59); Early afternoon (13:00 to 16:59); Early evening (17:00 to 18:59); Late evening (19:00 onwards).
* p < 0.1, ** p < 0.05, *** p < 0.01

Appendix C Table 2: Propensity Score Matching (PSM) Results

	Pre-game	5-minutes before	Half-time	Post-game	Total Programme
Post-ban (2019)	**0.34*****	**-0.38*****	**-2.16*****	**0.01**	**-2.20*****
	[0.10,0.58]	**[-0.45,-0.32]**	**[-2.32,-1.99]**	**[-0.20,0.21]**	**[-2.64,-1.76]**
Observations	736	1049	1042	1042	1045

Models report unstandardised coefficients; 95% confidence intervals in brackets
* p < 0.1, ** p < 0.05, *** p < 0.01

`

Appendix D: Covariate Balance Tables for Matching Models

Appendix D Table 1: Covariate Balance Tables for Inverse Probability Weighted (IPW) Matching Models

Matching Variables	Pre-game				5-minutes before				Half-time				Post-game				Total programme			
	St Diff		*Var Ratio*		*St Diff*		*Var Ratio*		*St Diff*		*Var Ratio*		*St Diff*		*Var Ratio*		*St Diff*		*Var Ratio*	
	Raw	*Match*	*Raw*	*Match*	*Raw*	*Match*	*Raw*	*Match*	*Raw*	*Match*	*Raw*	*Match*	*Raw*	*Match*	*Raw*	*Match*	*Raw*	*Match*	*Raw*	*Match*
Channel																				
Sky	0.04	0.00	0.99	1.00	-0.16	-0.01	0.98	1.00	-0.16	-0.01	0.98	1.00	-0.16	-0.01	0.98	1.00	-0.15	-0.01	0.98	1.00
TNT Sports	-0.02	0.00	0.99	1.00	-0.13	-0.01	0.93	1.00	-0.13	-0.01	0.93	1.00	-0.13	-0.01	0.93	1.00	-0.13	-0.01	0.93	1.00
Other	-0.09	0.00	0.72	0.99	0.38	0.02	2.24	1.04	0.38	0.02	2.20	1.04	0.38	0.02	2.20	1.04	0.37	0.02	2.20	1.04
Day of the week																				
Monday	0.06	0.00	1.22	1.01	0.03	0.01	1.11	1.03	0.03	0.01	1.12	1.03	0.03	0.01	1.12	1.03	0.03	0.01	1.11	1.03
Tuesday	-0.05	0.00	0.88	1.00	-0.07	-0.01	0.83	0.98	-0.07	-0.01	0.83	0.98	-0.07	-0.01	0.83	0.98	-0.07	-0.01	0.83	0.98
Wednesday	-0.07	0.00	0.82	0.99	-0.02	-0.01	0.95	0.96	-0.02	-0.01	0.96	0.96	-0.02	-0.01	0.96	0.96	-0.02	-0.01	0.96	0.96
Thursday	0.00	0.00	1.00	1.01	-0.06	-0.02	0.84	0.95	-0.07	-0.02	0.83	0.95	-0.07	-0.02	0.83	0.95	-0.07	-0.02	0.82	0.95
Friday	-0.09	-0.01	0.80	0.97	-0.07	-0.01	0.85	0.97	-0.06	-0.01	0.87	0.97	-0.06	-0.01	0.87	0.97	-0.07	-0.01	0.85	0.98
Saturday	0.03	0.00	1.03	1.00	-0.03	0.00	0.96	1.01	-0.04	0.00	0.94	1.00	-0.04	0.00	0.94	1.00	-0.04	0.00	0.95	1.00
Time of game																				
Early afternoon	0.04	0.00	1.08	1.00	0.06	0.02	1.12	1.03	0.06	0.02	1.12	1.03	0.06	0.02	1.12	1.03	0.06	0.02	1.12	1.03
Early evening	0.00	0.00	1.00	1.00	-0.03	0.00	0.96	0.99	-0.03	-0.01	0.95	0.99	-0.03	-0.01	0.95	0.99	-0.04	0.00	0.95	0.99
Late evening	-0.10	0.00	0.99	1.00	-0.10	-0.02	0.98	1.00	-0.10	-0.02	0.98	1.00	-0.10	-0.02	0.98	1.00	-0.09	-0.02	0.98	1.00

**For covariates to be well-balanced, standardised mean differences (St Diff) should be close to 0 in the matched column; variance ratios (Var Ratio) should be close to 1 in the matched column*

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Appendix D Table 2: Covariate Balance Tables for Propensity Score Matching (PSM) Models

Matching Variables	Pre-game				5-minutes before				Half-time				Post-game				Total programme			
	St Diff		***Var Ratio***		***St Diff***		***Var Ratio***		***St Diff***		***Var Ratio***		***St Diff***		***Var Ratio***		***St Diff***		***Var Ratio***	
	Raw	*Match*	*Raw*	*Matc h*	*Raw*	*Matc h*	*Raw*	*Matc h*	*Raw*	*Matc h*	*Raw*	*Matc h*	*Raw*	*Matc h*	*Raw*	*Matc h*	*Raw*	*Matc h*	*Raw*	*Matc h*
Channel																				
			0.9		-		0.9		-		0.9		-		0.9		-		0.9	
Sky	0.04	-0.03	9	1.01	0.16	0.00	8	1.00	0.16	0.00	8	1.00	0.16	0.00	8	1.00	0.15	0.00	8	1.00
	-		0.9		-		0.9		-		0.9		-		0.9		-		0.9	
TNT Sports	0.02	0.01	9	1.01	0.13	0.00	3	1.00	0.13	0.00	3	1.00	0.13	0.00	3	1.00	0.13	0.00	3	1.00
	-		0.7				2.2				2.2				2.2				2.2	
Other	0.09	0.04	2	**1.16**	0.38	0.00	4	1.00	0.38	0.00	0	1.00	0.38	0.00	0	1.00	0.37	0.00	0	1.00
Day of the week																				
			1.2				1.1				1.1				1.1				1.1	
Monday	0.06	0.02	2	1.07	0.03	0.03	1	1.09	0.03	0.03	2	1.09	0.03	0.03	2	1.09	0.03	0.03	1	1.09
	-		0.8		-		0.8		-		0.8		-		0.8		-		0.8	
Tuesday	0.05	0.03	8	1.06	0.07	0.00	3	1.00	0.07	0.00	3	1.00	0.07	0.00	3	1.00	0.07	0.00	3	1.00
	-		0.8		-		0.9		-		0.9		-		0.9		-		0.9	
Wednesday	0.07	-0.02	2	0.93	0.02	-0.04	5	0.91	0.02	-0.03	6	0.92	0.02	-0.03	6	0.92	0.02	-0.04	6	0.90
			1.0		-		0.8		-		0.8		-		0.8		-		0.8	
Thursday	0.00	0.07	0	**1.25**	0.06	0.01	4	1.04	0.07	-0.01	3	0.96	0.07	-0.01	3	0.96	0.07	0.01	2	1.04
	-		0.8		-		0.8		-		0.8		-		0.8		-		0.8	
Friday	0.09	-0.07	0	**0.86**	0.07	-0.04	5	0.90	0.06	-0.02	7	0.95	0.06	-0.02	7	0.95	0.07	-0.04	5	0.90
			1.0		-		0.9		-		0.9		-		0.9		-		0.9	
Saturday	0.03	-0.01	3	0.99	0.03	0.04	6	1.06	0.04	0.04	4	1.05	0.04	0.04	4	1.05	0.04	0.04	5	1.06
Time of game																				
			1.0				1.1				1.1				1.1				1.1	
Early aftern~n	0.04	0.02	8	1.04	0.06	0.04	2	1.07	0.06	0.06	2	**1.12**	0.06	0.06	2	**1.12**	0.06	0.04	2	1.08
			1.0		-		0.9		-		0.9		-		0.9		-		0.9	
Early evening	0.00	0.00	0	1.00	0.03	-0.07	6	0.92	0.03	-0.05	5	0.94	0.03	-0.05	5	0.94	0.04	-0.07	5	0.92
	-		0.9		-		0.9		-		0.9		-		0.9		-		0.9	
Late evening	0.10	-0.01	9	1.00	0.10	0.01	8	1.00	0.10	-0.01	8	1.00	0.10	-0.01	8	1.00	0.09	0.01	8	1.00

**For covariates to be well-balanced, standardised mean differences (St Diff) should be close to 0 in the matched column; variance ratios (Var Ratio) should be close to 1 in the matched column*

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10.5 Appendix 5: Appendix for Chapter Eight

Appendix A: List of Sports in ‘Other Sports’ Genre (live and non-live)

1. American Football
2. Angling/Fishing
3. Athletics
4. Ballet
5. Basketball
6. Boxing
7. Clay Pigeon Shooting
8. Composite
9. Contact Sports
10. Cricket
11. Curling
12. Cycling
13. Dance
14. Darts
15. Extreme Sports
16. Figure Skating
17. Formula One
18. Gaelic Football
19. Golf
20. Gymnastics
21. Hockey
22. Hurling
23. Ice Hockey
24. Judo
25. Magazine
26. Motor Racing
27. Miscellaneous
28. Netball
29. News
30. Poker
31. Powerboat Racing
32. Rugby (League and Union)
33. Show Jumping
34. Snooker/Pool/Billiards
35. Special Events
36. Squash
37. Swimming/Diving
38. Table Tennis
39. Tennis
40. Triathlon
41. Volleyball

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42. Water Sports
43. Weightlifting
44. Winter Sports
45. Wrestling

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Appendix B: Advertisements by Live Sports Subgenre

Subgenre (Live sports)	Total					2018					2019				
	Freq	%	Total hours	Adv/ hour	Adv/ prog	Freq	%	Total hours	Adv/ hour	Adv/ prog	Freq	%	Total hours	Adv/ hour	Adv/ prog
American Football	14	0.09%	408	0.03	0.11	11	0.12%	156	0.07	0.22	3	0.05%	253	0.01	0.04
Athletics	5	0.03%	79	0.06	0.08	4	0.04%	60	0.07	0.08	1	0.02%	19	0.05	0.07
Basketball	190	1.27%	234	0.81	1.81	185	2.04%	91	2.03	4.74	5	0.08%	142	0.04	0.08
Boxing	185	1.23%	114	1.62	3.25	88	0.97%	43	2.03	7.33	97	1.64%	71	1.37	2.16
Clay Pigeon Shooting	0	0.00%	4	0.00	0.00	0	0.00%	0	0.00	0.00	0	0.00%	4	0.00	0.00
Contact Sports	92	0.61%	85	1.08	1.84	17	0.19%	14	1.19	2.13	75	1.27%	71	1.06	1.79
Cricket	1089	7.27%	1104	0.99	3.86	804	8.87%	517	1.56	5.78	285	4.82%	587	0.49	1.99
Curling	0	0.00%	68	0.00	0.00	0	0.00%	59	0.00	0.00	0	0.00%	9	0.00	0.00
Cycling	85	0.57%	1228	0.07	0.08	50	0.55%	749	0.07	0.07	35	0.59%	479	0.07	0.09
Darts	641	4.28%	396	1.62	5.25	310	3.42%	126	2.47	8.86	331	5.59%	270	1.23	3.80
Extreme Sports	6	0.04%	22	0.27	0.21	3	0.03%	3	0.96	0.43	3	0.05%	19	0.16	0.14
Figure Skating	0	0.00%	203	0.00	0.00	0	0.00%	203	0.00	0.00	0	0.00%	0	0.00	0.00
Formula One	223	1.49%	334	0.67	0.82	178	1.96%	199	0.90	1.16	45	0.76%	135	0.33	0.38
Football	4558	30.42 %	2939	1.55	3.46	286 4	31.59 %	1174	2.44	5.81	1694	28.62 %	1766	0.96	2.05
Gaelic Football	1	0.01%	3	0.29	1.00	1	0.01%	3	0.29	1.00	0	0.00%	0	0.00	0.00
Golf	2639	17.61 %	2078	1.27	3.62	182 9	20.17 %	1022	1.79	4.94	810	13.68 %	1056	0.77	2.26
Horse Racing	3939	26.29 %	1307	3.01	14.02	181 8	20.05 %	*653*	2.78	12.99	2121	35.83 %	654	3.24	15.04
Judo	0	0.00%	41	0.00	0.00	0	0.00%	28	0.00	0.00	0	0.00%	12	0.00	0.00
Motor Racing	105	0.70%	1437	0.07	0.07	69	0.76%	616	0.11	0.09	36.0	0.61%	821	0.04	0.05
Netball	96	0.64%	83	1.16	2.18	96	1.06%	65	1.49	2.74	0.0	0.00%	18	0.00	0.00
Powerboat Racing	126	0.84%	310	0.41	2.09	23	0.25%	10	2.29	2.09	103. 0	1.74%	300	0.34	0.67
Rugby	174	1.16%	310	0.56	0.92	174	1.92%	293	0.59	1.18	0.0	0.00%	17	0.00	0.00
Show Jumping	242	1.61%	578	0.42	0.00	0	0.00%	43	0.00	0.00	242. 0	4.09%	535	0.45	0.98

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Snooker/Pool/Billiards	182	1.21%	725	0.25	0.66	178	1.96%	678	0.26	0.46	4.0	0.07%	47	0.09	0.06
Sport- Misc	40	0.27%	109	0.37	0.20	37	0.41%	100	0.37	0.27	3.0	0.05%	9	0.34	0.16
Sport - Special Events	41	0.27%	98	0.42	0.41	25	0.28%	40	0.62	0.51	16.0	0.27%	58	0.27	0.64
Table Tennis	0	0.00%	86	0.00	0.00	0	0.00%	50	0.00	0.00	0.0	0.00%	36	0.00	0.00
Tennis	227	1.51%	488	0.47	1.15	227	2.50%	331	0.69	2.16	0	0.00%	157	0.00	0.00
Triathlon	1	0.01%	47	0.02	0.01	0	0.00%	19	0.00	0.00	1.0	0.02%	29	0.04	0.02
Watersports	0	0.00%	33	0.00	0.00	0	0.00%	3	0.00	0.00	0.0	0.00%	30	0.00	0.00
Weight Lifting	67	0.45%	56	1.19	1.91	66	0.73%	54	1.23	2.06	1.0	0.02%	3	0.37	0.33
Winter Sports	1	0.01%	415	0.00	0.00	1	0.01%	122	0.01	0.01	0.0	0.00%	294	0.00	0.00
Wrestling	16	0.11%	246	0.06	0.12	8	0.09%	116	0.07	0.12	8.0	0.14%	130	0.06	0.12
TOTAL (Live sports)	***1498 5***	**100%**	**15669**	**0.6**	**1.5**	**906 6**	**100%**	**7639**	**0.8**	**2.0**	**5919**	**100%**	**8029**	**0.4**	**1.0**

Appendix B Table 1: Advertisements by all live sports subgenres

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Appendix C: Coefficients from Additional Models

	Live Football	Live Racing	Other Live Sports	Non-live Football	Non-live Racing	Other Non-live Sports
Change 2018-2019 **in advertisements per hour of programming**	-1.13*** [-1.30,-0.96]	0.36* [-0.04,0.76]	-0.25*** [-0.29,-0.21]	-0.01 [-0.05,0.03]	-0.27*** [-0.39,-0.16]	-0.23*** [-0.25,-0.21]
Change 2018 – 2019 **using Poisson models** (coefficients are incidence-rate ratios)	0.52*** [0.49,0.56]	1.23*** [1.16,1.31]	0.49*** [0.47,0.51]	0.94*** [0.89,0.98]	0.50*** [0.39,0.64]	0.65*** [0.63,0.66]

Appendix C Table 1: Coefficients from additional sports models (linear models using advertisements per-hour of programming as the outcome variable; Poisson models using total advertisements per-programme as the outcome variable).

	Documentaries	Drama	Entertainment	Leisure	Music	News	Film	Other (unassigned)
Change 2018-2019 **in advertisements per hour of programming**	-0.12*** [-0.14,-0.11]	-0.02** [-0.04,-0.00]	0.01 [-0.00,0.02]	-0.04*** [-0.07,-0.02]	-0.09*** [-0.15,-0.04]	0.15*** [0.11,0.20]	0.08*** [0.07,0.10]	-0.10*** [-0.11,-0.10]
Change 2018-2019 **using Poisson models** (coefficients are incidence-rate ratios)	0.88*** [0.86,0.89]	0.94*** [0.92,0.96]	0.95*** [0.94,0.97]	0.98 [0.95,1.01]	0.45*** [0.42,0.48]	1.57*** [1.48,1.66]	1.24*** [1.21,1.27]	0.83*** [0.83,0.84]

Appendix C Table 2: Coefficients from additional non- sports models (linear models using advertisements per-hour of programming as the outcome variable; Poisson models using total advertisements per-programme as the outcome variable).

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Column Number	1	2	3	4	5	6	7	8
Genre	Linear Coefficient	Poisson Coefficient	2018 Adv/ Prog	2019 Adv/ prog	Poisson check	Adv/ hour	Average hours	Adv/hour check
Live Football	-2.93***	0.52***	5.81	2.05	3.02	-1.13***	2.23	-2.52
Football	0.01	0.94***	0.48	0.53	0.45	-0.01	0.51	-0.01
Live Racing	2.56***	1.23***	12.99	15.04	15.98	0.36*	4.65	1.67
Racing	-0.17***	0.50***	0.42	0.19	0.21	-0.27***	0.94	-0.25
Other Live Sports	-0.83***	0.49***	1.48	0.65	0.73	-0.25***	1.77	-0.44
Other Sports	-0.24***	0.65***	0.77	0.49	0.50	-0.23***	0.72	-0.17
Documentaries	-0.15***	0.88***	0.89	0.78	0.78	-0.12***	0.79	-0.09
Drama	-0.07***	0.94***	0.71	0.76	0.67	-0.02**	0.81	-0.02
Entertainment	-0.03***	0.95***	0.42	0.41	0.40	0.01	0.54	0.01
Leisure	-0.03**	0.98	0.59	0.55	0.58	-0.04***	0.77	-0.03
Music	-0.33***	0.45***	0.97	0.43	0.44	-0.09***	1.23	-0.11
News	0.09***	1.57***	0.16	0.28	0.25	0.15***	0.44	0.07
Film	0.15***	1.24***	0.64	0.91	0.79	0.08***	1.72	0.14
Other Genre	-0.06***	0.83***	0.4	0.34	0.33	-0.10***	0.64	-0.06

Appendix C Table 3: A comparison of coefficients between the three models

Note: All models produce similar results and support the conclusions in the main paper. ***Appendix C Table 3*** *compares the coefficients in all three models. In this table, if columns 4 and 5 are similar, then the Poisson models report similar results to the main linear models. If columns 1 and 8 are similar, then the advert per-hour of programming models report similar results to the main linear models. Results are broadly similar across models despite some variation in magnitude. Variation in magnitude is expected across samples and models. In the adverts per-hour of programming model for horse racing, significance and magnitude are lower. Despite this, results for the count data model and alternative linear model, which both control for the length of the programme, corroborate one another. Linear models have been reported in the main paper for ease of interpretation.*