



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Contents lists available at ScienceDirect

Neuroscience and Biobehavioral Reviews

journal homepage: www.elsevier.com/locate/neubiorev

Review article

COVID-19 and resultant restrictions on gambling behaviour

Anthony Quinn^{a,*}, Jon E. Grant^b, Samuel R. Chamberlain^{a,c}^a Department of Psychiatry, Faculty of Medicine, University of Southampton, UK^b Department of Psychiatry & Behavioral Neuroscience, University of Chicago, USA^c Southern Health NHS Foundation Trust, Southampton, UK

ARTICLE INFO

Keywords:

Gambling
 Betting
 Online
 Casino
 COVID-19
 Pandemic
 Mapping review

ABSTRACT

Since the onset of COVID-19, studies suggest a significant increase in online gambling, potentially facilitated by increased time at home, social isolation and boredom. This study aimed to address what is known about the impact of the pandemic on gambling behaviour by conducting a mapping review. A systematic literature search was conducted using four online databases. Additional studies were identified using reference lists. Relevant studies were quality scored and their findings synthesised in terms of overall changes at the population level and potentially vulnerable groups. The weight of evidence from 35 relevant reports across 12 countries indicated reductions of gambling during the pandemic at the level of the general population. However, marked increases in gambling amongst vulnerable sub-populations including amongst young adults and people with pre-existing at-risk gambling were also noted. The impact of COVID-19 on gambling is highly contingent on context. If policy makers examine only population level data, this could overlook profound negative effects identified in those with at-risk gambling, gambling disorder, and amongst young adults.

1. Introduction

On 16th March 2020, the Prime Minister of the United Kingdom [UK] announced that due to COVID-19, all non-essential contact and travel should cease and this was the first in a series of restricted measures and lockdowns (Institute for Government, 2022). These stipulations were in place in some guise until February 2022 when the Prime Minister of the UK announced that all COVID-19 domestic restrictions in law were to be removed (GOV.UK, 2022). Similar restrictions were put in place in many countries around the world although to varying degrees in terms of strictness and duration/ time course. During this time, especially in the first half of 2020, to limit the spread of the coronavirus many parts of the globe limited or stopped sporting events; non-essential retail shops were mandated to close; people were instructed to work remotely where possible and people spent increased periods of time at home away from friends and non-immediate family.

As a result of stark lifestyle changes, extended periods of physical isolation at home and possible anxiety, boredom and depression there were concerns about the commencement or a worsening of maladaptive compulsive and impulsive behaviours, such as gambling (see Fontenelle and Miguel, 2020; Fontenelle et al., 2021; Håkansson et al., 2020a; King et al., 2020). In the UK, news reports described how interest in online

casinos reached an all-time high during the pandemic in May 2020 (Homer, 2020); and described how betting customers were turning to sometimes riskier games such as casino and poker for entertainment under heightened restrictions (BBC News, 2020). Håkansson et al. (2021) called for research into day trading on stock exchanges as an addictive behaviour and how this may have changed as a result of the pandemic. Concerns about online gambling are not new and have existed since its introduction (see National Gambling Impact and Policy, 1999). However within the context of COVID-19, resultant restrictions and lifestyle changes, these considerations became heightened whilst it remained possible to gamble 24 hours per day (Sharman et al., 2021a).

In light of the described social upheaval and previous findings that suggest times of crisis may affect gambling behaviour (Economou et al., 2019), some reviews have been undertaken to discern how gambling may have changed during the COVID-19 pandemic; they have analysed self-report data, administrative data, behavioural tracking data, literature reviews and discussion pieces. Two reviews found that the impacts of the pandemic on gambling behaviour and gambling problems were varied (Hodgins and Stevens, 2021; Sachdeva et al., 2021) whilst another concluded that the impacts were unclear (Brodeur et al., 2021). Public Health England (2021) conducted the only review which more confidently suggests that there was a reduction in overall gambling

* Correspondence to: Academic Centre, College Keep, 4-12 Terminus Terrace, Southampton, Hampshire, SO14 3DT, UK.

E-mail address: a.quinn@soton.ac.uk (A. Quinn).

<https://doi.org/10.1016/j.neubiorev.2022.104932>

Received 8 April 2022; Received in revised form 21 October 2022; Accepted 26 October 2022

Available online 29 October 2022

0149-7634/© 2022 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

during COVID-19 restrictions; however, this finding applied only to the initial COVID-19 lockdown in the UK [March to June 2020]. Thus, follow-up studies have been called for in order to assess the longer term implications of COVID-19 on gambling behaviour (Hodgins and Stevens, 2021).

After more than two years since the onset of COVID-19 and after pandemic related restrictions were almost entirely lifted in most countries, the contribution of this mapping review was to evaluate a complete body of evidence and to rank its quality in order to inform understanding of gambling during a pandemic. Moreover, with the publication of further gambling studies since previous reviews were published, this paper sought to provide more precise insight into the populations for whom a change in gambling behaviour has been most pronounced. Identification of groups who may be at increased risk is necessary given that gambling subtypes and classifications are needed from a neurobiological and clinical standpoint (Chamberlain et al., 2017). For example, while research has suggested that the median age of people who gamble is 31 years, there is a notable concern about high rates of gambling [and escalating rates] in young people (Woodruff and Gregory, 2005). Other groups may also be at disproportionate risk of gambling problems (see Okuda et al., 2016) and mental health may have deteriorated due to the onset of the pandemic.

2. Method

A mapping review (also known as a systematic map) is designed to present and categorise published findings on a particular topic (Grant and Booth, 2009). Unlike a rapid review that restricts the inclusion of literature based on year or country of publication or a scoping review that assesses the types of studies that have been carried out (Petticrew and Roberts, 2006), a mapping review can provide an assessment of the quantity and quality of all available evidence through tabular or graphical representation (Grant and Booth, 2009). A mapping review presents opportunities to document the limitations of previous studies and areas for further research (Grant and Booth, 2009). Conducting a mapping review was required in the aftermath of multiple waves of COVID-19, due to the heterogenous nature of studies about gambling and the pandemic. The designs of these studies were diverse and standard units of measurement for gambling were not used across twelve countries wherein gambling and gambling legislation varies. Therefore, a mapping approach was deemed to be appropriate and advantageous. All studies reported in English were screened within EndNote. R Studio and Excel were used to compile and analyse reports. The online databases MEDLINE, Embase, APA PsycInfo, the International Bibliography of the Social Sciences and the reference lists of search results were used for the screening process. One researcher undertook the screening and scoring of studies and this was independently ratified by another researcher. A focus on studies written in the English language was pragmatic due to the large resource demands of conducting a pan-language review. To be included, reports of studies needed to include: primary data; self-report data; data from participants 18 years and older; data on gambling behaviour (i.e. not experiences of addiction treatment); comparison of gambling and non-gambling before and after the onset of COVID-19. The screening of database results was completed at the end of January 2022 using the following search string: ((COVID-19[MESH]) OR (Coronavirus[MESH]) OR (2019-nCoV) OR (SARS-CoV) OR (MERS-CoV) OR (Severe Acute Respiratory Syndrome [MESH]) OR (Middle East Respiratory Syndrome)) AND ((Gambling) OR (Betting) OR (Wagering) OR (Bingo) OR (Casino) OR (Lotto) OR (Lottery)).

We assessed and categorised quantitative studies based on their methodological design and evidence. Our assessment for quality and inclusion was based on the following criteria. Firstly, whether the study sample was comprised of a general population or a population specific to gambling. If the sample included a specific population unrelated to gambling, i.e. professional athletes (Håkansson et al., 2020b), it was not

included. Secondly, whether study sample sizes had a 5 % margin of error or less. This was important to ascertain if a study sample was large enough to account for no more than 5 % error. At the 90 % confidence level, a sample size of 272 will guarantee a maximum 5 % margin of error for estimation; when increased to 425, the margin of error will be no greater than 4 % and so on (Sue and Ritter, 2012). Put differently, the greater the margin of error, the less confidence there can be that results are reflective of a wider population from which participants were drawn. Thirdly, we assessed whether sample weightings, control for variables or post-hoc tests were reported. These were important for examining the representativeness of samples, the true effects of study variables and statistical significance of changes in gambling. Previous findings were categorised in groups named: "overall reduction of gambling since the onset of COVID-19", "inconsistent or negligible change in gambling behaviour since the onset of COVID-19" and "exacerbation of gambling since the onset of COVID-19". Secondary quantitative data were then categorised and thematically analysed by age, gender, employment, education, previous/ current gambling and mental health to achieve the aim of discovering what impact COVID-19 had on gambling behaviour.

A study scored a 3 (highest quality) if it reported a sample size with a 5 % margin of error less (90 % confidence level) alongside sample weighting or control variables or post-hoc tests. A study scored a 1 (lowest quality) if it neither reported a sample size with a 5 % margin of error or less nor sample weighting, control variables nor post-hoc tests. Studies that only reported one of these scored a 2.

3. Results

An overview of identified studies and our screening are provided in the PRISMA flow diagram [Fig. 1]. Thirty-five relevant publications met our inclusion criteria and these were published across 12 countries. Table 1 contains a list of all eligible study reports. Tables S1 and S2 provide an overview of the evidence in support of an overall reduction in gambling and an exacerbation of gambling since the onset of the COVID-19 pandemic. Tables S3-S7 describe how gambling may have differed by gender, age, education and employment, previous/ current gambling and mental health. The impact of the pandemic on gambling varied depending on the nature of the population under study. Findings observed at the level of the general population differed from those reported in vulnerable groups, such as in people with a history of gambling disorder or at-risk gambling and in young adults.

3.1. Overall population level changes

Most of the studies suggested an overall reduction in gambling amongst the general population [Table S1]. There was some evidence that the onset of the pandemic had an inconsistent or no impact on gambling behaviour and there was limited evidence which indicated a detrimental impact on gambling amongst the general population [Table S2]. In Australia [sample: 3029], around 52.9 % were estimated to have gambled three months into the pandemic compared to 65.9 % pre-pandemic (Biddle, 2020); nearly one-third of gamblers in Canada reported that they had stopped during the lockdown and among those who continued to gamble, significant decreases were detected (Shaw et al., 2021). Studies also found a reduced gambling frequency. In the UK [sample: 3001], 41 % of participants reported gambling less during lockdown compared to 4 % who gambled more (Gunstone et al., 2020); in New Zealand, 50 % of gamblers reported gambling less compared to 9 % who reported an increase (Health Promotion Agency, 2020a). As might be expected due to closures of non-essential retail, in Sweden land-based gambling was markedly lower than before COVID-19 but there was little reduction for online casino and online bingo (Håkansson, 2020b).

Amongst the evidence which inferred inconsistent or no impacts on gambling after the onset of COVID-19, Black et al. (2021) found no

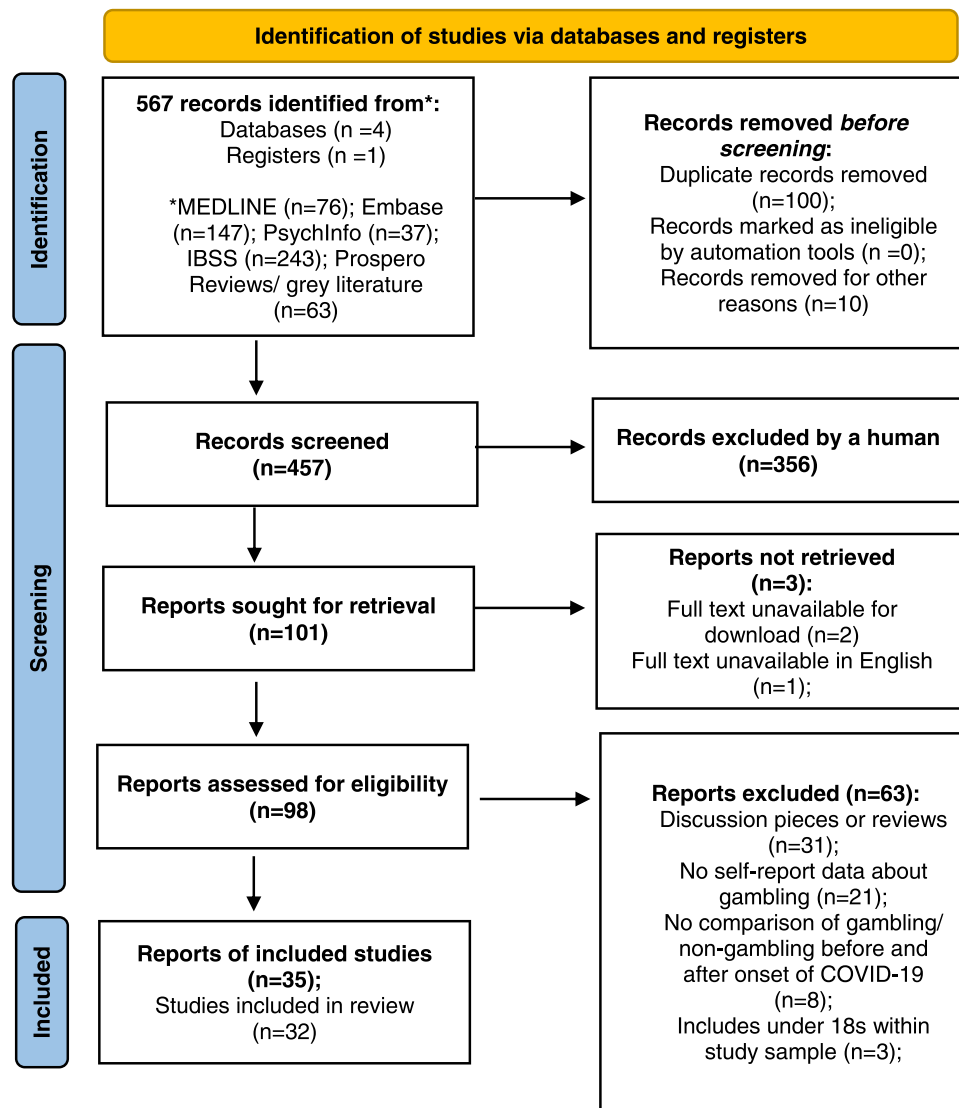


Fig. 1. PRISMA flow diagram for the screening of relevant studies (Price et al., 2021).

significant differences in online gambling between Australian states that did and did not experience COVID-19 restrictions. There were studies that described decreases in gambling but also revealed increases in gambling frequency or non-gamblers taking up gambling. In the UK [sample: 3866], approximately 30 % of males and 33 % of females reported that they ceased gambling; however, approximately 17 % of males and females started at least one new gambling activity during the initial COVID-19 lockdown [March 2020 – June 2020] (Wardle et al., 2021). Similarly in the US, amongst 424 participants who had previously gambled, there was a significant decrease in online gambling but 8 % of this sample who had not previously gambled did so for the first time after the onset of COVID-19 (Xuereb et al., 2021). Gambling behaviour may have been negatively impacted amongst specific cohorts; Emond et al. (2022) and Price et al. (2022) found that online gambling increased for groups of occasional or regular gamblers.

The COVID-19 pandemic may have resulted in more problematic gambling albeit most of the evidence to support this was labelled as lower quality. Maraz et al. (2021) suggested that gambling, amongst other potentially addictive behaviours such as gaming and drug use, significantly increased during the first six months of the pandemic in the US (Maraz et al., 2021). Jenkinson et al. (2020) alluded to an increase in gambling frequency with the proportion of individuals who gambled on 4 occasions or more per week increasing from 23 % to 32 % [sample:

2019]. In Italy, the onset of COVID-19 between March and May 2020 resulted in 23.6 % of gamblers suffering from pathological gambling; a much higher figure than would normally be expected (Salerno and Pallanti, 2021).

3.2. Changes amongst vulnerable groups

Population level changes in behaviour or mental health during the pandemic can obscure more pronounced effects in vulnerable sub-populations. This has been established for areas of mental health such as anxiety (Hampshire et al., 2021) and so this review also considered the relevance of key contextual information within identified studies. Understanding individual characteristics of different groups who gamble may be highly relevant for better researching neurobiological and clinical facets of at-risk gambling, full gambling disorder and for targeting support at vulnerable sub-populations (Chamberlain et al., 2017; Okuda et al., 2016). Addressing who may have been at greater risk of gambling (and those showing exacerbation of gambling) since the onset of COVID-19 likely outweighs the need to identify overall population level trends in behaviour.

Reports of studies that were assigned a score of either 3 or 2 were further assessed for information about cohorts who were, and may continue to be, at increased risk of problematic gambling since the start

Table 1

A list of 35 eligible reports of studies collected from February 2020 until January 2022.

| Authors | Country | Publication Type | Survey Design | Sample Size | Sample Population | Score | At-risk gambling by: gender; | age [cohort]; | education/ employment; | previous/ current gambling; | mental health. |
|----------------------------------|-------------|-------------------------|----------------------------------|-------------|------------------------|-------|------------------------------|---------------|------------------------|-----------------------------|----------------|
| Abacus Data (2020) | Canada | Market Research Report | Cross-sectional, online | 1500 | General population | 3 | ✓ | ✓ | | | |
| Albertella et al. (2021) | Australia | Journal Article | Cross-sectional, online | 878 | General population | 3 | | ✓ | | ✓ | |
| Alessi et al. (2022) | Italy | Journal Article | Cross-sectional | 153 | Gamblers in treatment | 2 | | | | | |
| Aslan and Kilincel (2021) | Turkey | Journal Article | Cross-sectional, online | 203 | General population | 1 | | | | | |
| Bellringer and Garrett (2021) | New Zealand | Journal Article | Cross-sectional, telephone | 301 | Self-reported gambling | 3 | | | ✓ | ✓ | ✓ |
| Biddle (2020) | Australia | Academic Paper | Longitudinal | 3029 | General population | 3 | ✓ | ✓ | ✓ | ✓ | |
| Black et al. (2021) | Australia | Journal Article | Longitudinal, online | 462 | Self-reported gambling | 3 | | | | ✓ | |
| Brown and Hickman (2020) | Australia | Academic Paper | Cross-sectional, online | 1000 | General population | 3 | ✓ | ✓ | ✓ | ✓ | |
| Donati et al. (2021) | Italy | Journal Article | Cross-sectional, telephone | 135 | Gamblers in treatment | 1 | | | | | |
| Emond et al. (2022) | UK | Journal Article | Longitudinal, online | 2632 | General population | 2 | ✓ | ✓ | ✓ | ✓ | ✓ |
| Fluharty and Fancourt (2021) | UK | Journal Article | Longitudinal, online | 26,016 | General population | 3 | ✓ | ✓ | ✓ | | |
| Gainsbury et al. (2021) | Australia | Journal Article | Cross-sectional, online | 769 | Self-reported gambling | 2 | | | | ✓ | |
| Georgiadou et al. (2021) | Germany | Journal Article | Cross-sectional, online | 3245 | General population | 2 | ✓ | ✓ | | | |
| Gunstone et al. (2020) | UK | Charity Research Report | Repeated cross-sectional, online | 3001 | General population | 3 | ✓ | ✓ | | ✓ | ✓ |
| Håkansson (2020a) | Sweden | Journal Article | Cross-sectional, online | 2016 | General population | 3 | ✓ | ✓ | ✓ | ✓ | |
| Håkansson (2020b) | Sweden | Journal Article | Cross-sectional, online | 997 | Self-reported gambling | 2 | ✓ | ✓ | ✓ | ✓ | |
| Håkansson (2021) | Denmark | Journal Article | Cross-sectional, online | 2012 | General Population | 2 | ✓ | ✓ | ✓ | ✓ | ✓ |
| Håkansson and Widingshoff (2020) | Sweden | Journal Article | Cross-sectional, online | 2029 | General Population | 2 | | ✓ | ✓ | ✓ | |
| Health Promotion Agency (2020a) | New Zealand | Public Sector Report | Cross-sectional, online | 1190 | General Population | 3 | | ✓ | | | |
| Health Promotion Agency (2020b) | New Zealand | Public Sector Report | Cross-sectional online | 925 | General Population | 3 | | | | | |
| Jenkinson et al. (2020) | Australia | Govt research report | Cross-sectional, online | 2019 | General Population | 2 | ✓ | ✓ | | | |
| Lischer et al. (2021) | Switzerland | Journal Article | Longitudinal, online | 110 | Self-reported gambling | 2 | ✓ | | | | ✓ |
| Lugo et al. (2021) | Italy | Journal Article | Cross-sectional, online | 6003 | General Population | 3 | ✓ | ✓ | | | ✓ |
| Maraz et al. (2021) | USA | Journal Article | Repeated cross-sectional, online | 1430 | General Population | 2 | | | | | |
| Price (2020) | Canada | Journal Article | Cross-sectional, online | 2005 | Self-reported gambling | 2 | ✓ | ✓ | ✓ | ✓ | |
| Price et al. (2022) | Canada | Journal Article | Repeated cross-sectional, online | 940 | Self-reported gambling | 2 | | | ✓ | ✓ | |

(continued on next page)

Table 1 (continued)

| Authors | Country | Publication Type | Survey Design | Sample Size | Sample Population | Score | At-risk gambling by: gender; | age [cohort]; | education/ employment; | previous/ current gambling; | mental health. |
|-----------------------------|---------|------------------------|----------------------------------|-------------|------------------------|-------|------------------------------|---------------|------------------------|-----------------------------|----------------|
| Rantis et al. (2021) | Greece | Journal Article | Cross-sectional, online | 70 | General Population | 1 | ✓ | | | | |
| Salerno and Pallanti (2021) | Italy | Journal Article | Cross-sectional, online | 194 | General Population | 2 | ✓ | ✓ | ✓ | | |
| Sharman et al. (2021a) | UK | Journal Article | Cross-sectional, online | 1028 | General Population | 3 | | | ✓ | ✓ | |
| Sharman et al. (2021b) | UK | Journal Article | Cross-sectional, online | 1028 | General Population | 3 | | | | | ✓ |
| Shaw et al. (2021) | Canada | Journal Article | Repeated cross-sectional, online | 3449 | General Population | 3 | | ✓ | ✓ | ✓ | |
| Survation (2020) | UK | Market Research Report | Cross-sectional | 1010 | General Population | 2 | | | | | |
| Wardle et al. (2021) | UK | Journal Article | Cross-sectional, online | 3866 | Self-reported gambling | 3 | ✓ | ✓ | ✓ | ✓ | |
| Xuereb et al. (2021) | USA | Journal Article | Cross-sectional, online | 424 | Self-reported gambling | 2 | | | ✓ | ✓ | |
| Zamboni et al. (2021) | Italy | Journal Article | Cross-sectional, online | 1232 | General Population | 2 | | | | | |

of COVID-19. Table S3 shows that most studies which examined gambling by gender either found that males were more likely to start gambling/ increase their gambling/ spend more on gambling than females (Abacus Data, 2020; Brown and Hickman, 2020; Jenkinson et al., 2020; Lugo et al., 2021; Price, 2020; Salerno and Pallanti, 2021; Wardle et al., 2021) or that there was little association by gender (Biddle, 2020; Georgiadou et al., 2021; Håkansson, 2020a, 2020b). Only three studies found that increased gambling was associated with female gender (Håkansson, 2021), that males were less likely to have increased their gambling frequency (Fluharty and Fancourt, 2021) or that males were more likely to report gambling less during COVID-19 restrictions (Gunstone et al., 2020).

Table S4 shows that younger adults were more likely to increase some aspect of gambling during the pandemic (Abacus Data, 2020; Albertella et al., 2021; Brown and Hickman, 2020; Emond et al., 2022; Gunstone et al., 2020; Håkansson, 2020a; Håkansson, 2021; Håkansson and Widinghoff, 2021; Health Promotion Agency, 2020a; Jenkinson et al., 2020; Price, 2020; Shaw et al., 2021; Wardle et al., 2021). Where there were declines in gambling, these were larger amongst older people (Biddle, 2020; Lugo et al., 2021). Georgiadou et al. (2021) and Håkansson (2020b) reported no association between age and changed gambling behaviour whilst only Fluharty and Fancourt (2021) and Salerno and Pallanti (2021) stated that older adults were more likely to gamble during the pandemic. Where younger adults were found to be increasingly likely to engage in more problematic gambling, the reported age cohorts at risk were 18–24 year olds (Health Promotion Agency, 2020a; Price, 2020), 18–30 year olds (Abacus Data, 2020; Brown and Hickman, 2020) and 18–34 year olds (Emond et al., 2022; Gunstone et al., 2020; Jenkinson et al., 2020; Wardle et al., 2021). Since the onset of COVID-19, these age cohorts were reported to have been more likely to gamble online (Price, 2020), to have gambled more than usual (Abacus Data, 2020; Brown and Hickman, 2020; Gunstone et al., 2020; Health Promotion Agency, 2020a) and to have spent more on gambling (Emond et al., 2022; Jenkinson et al., 2020).

There was conflicting evidence in regards to education and employment and their correlation with gambling behaviour during COVID-19 [Table S5]. Håkansson (2021) found differences in gambling based on employment status whereas other studies found no relationship between gambling and employment status (Emond et al., 2022; Håkansson, 2020a, 2020b; Shaw et al., 2021). Bellringer and Garrett (2021) reported that those who were highly educated were more likely

to gamble [online]; however, Biddle (2020) stated that high levels of education were linked to a decline in at-risk gambling. There were suggestions that full-time employees were most likely to gamble during the pandemic (Brown and Hickman, 2020; Fluharty and Fancourt, 2021) but also evidence indicating that those who worked part-time or who were without employment were more likely to gamble (Håkansson and Widinghoff, 2021; Sharman et al., 2021a; Wardle et al., 2021). To compound the lack of distinction between education, employment and gambling, Salerno and Pallanti (2021) found that many pathological gamblers were either unemployed or business owners.

Gambling after the onset of COVID-19 was correlated with gambling prior to the pandemic [Table S6]. More problematic gambling pre-COVID was associated with more problematic gambling during lockdown (Albertella et al., 2021). The only groups that did not report a reduction in gambling frequency during the pandemic were those who reported gambling daily or between two and six times per week pre-lockdown (i.e. those more likely to have at-risk gambling or gambling disorder) (Sharman et al., 2021a). After the onset of COVID-19, increased [online] gambling was associated with categorisation in at-risk groups and higher scores on the Problem Gambling Severity Index (Bellringer and Garrett, 2021; Gunstone et al., 2020; Håkansson, 2020a, 2021; Håkansson and Widinghoff, 2021). Black et al. (2021) reported no significant reduction in frequency of gambling based on moderate to high risk of gambling at baseline. However, Biddle (2020) observed beneficial impacts even for those who gambled prior to the pandemic. Declines in moderate risk and high risk/ problem gambling were reported between November 2019 and November 2020 [a period of heightened COVID-19 restrictions in Australia]; whilst Gainsbury et al. (2021) found no association between problem gambling score and increases in gambling frequency.

The majority of studies found that gambling had a detrimental impact on mental health [Table S7]. In the UK, although levels of depression, anxiety and stress were reported to have increased during the lockdown across a gambling and non-gambling sample ($n = 1028$), those classified as Potential Problem Gamblers reported higher levels of depression, stress and anxiety ($p < 0.05$) (Sharman et al., 2021b). Amongst a study sample ($n = 2012$) in Denmark, 87 % of those who reported an increase in gambling were more likely to screen positive for mental distress compared to 42 % of those who did not ($p < 0.001$) (Håkansson, 2021). In Switzerland, there were significant relationships between those who had gambled and poorer mental health (Lischer

et al., 2021). Individuals who gambled during heightened restrictions reported stronger symptoms of depression and anxiety; mean scores on the PHQ-4 were 5.83 vs 2.63 ($p < 0.001$). There were similar findings in Canada (Price et al., 2022) and Italy (Lugo et al., 2021). Of the studies that found marginal or no impacts of gambling on mental health, no relationship between anxiety and gambling frequency was found in a UK-based study (Emond et al., 2022) and the use of gambling-related advice, support and treatment remained largely unchanged during the first year of the pandemic (Gunstone et al., 2020). Whether more people were experiencing gambling-related issues and not seeking assistance is open to investigation.

4. Discussion

This review provides valuable insights into the potential impact of a pandemic on gambling yet several limitations should be considered. Many studies included in this review were cross-sectional rather than longitudinal and may have been affected by recall bias. Another limitation is that we focused on self-report data; these are important because individual perspectives are of paramount importance however some individuals may be reluctant to describe the true extent of their gambling, or may provide socially acceptable responses (Stone et al., 2009). It would be of interest if future work also considers other types of data. Examination of real-life gambling data (ecological data) would be valuable albeit such data are commonly collected by organisations that do not permit uncensored data to be made available for scrutiny. For pragmatic reasons, we focused on studies reported in English. Findings in other languages may have been overlooked and cultural differences in respect to gambling should be considered in future work. This review did not include studies conducted in Africa, Asia or in Hispanic countries where the strictness of COVID-19 restrictions, public policy towards gambling or gambling may have been different. Lastly, the heterogeneous nature of the identified studies (in terms of outcome measures and sample characteristics) meant that conducting a subsequent meta-analysis was not appropriate and that screening and scoring of past studies may have resulted in some “selective outcome reporting bias” (Eden et al., 2011) where greater emphasis is placed on larger studies. Furthermore, minority groups may be at high-risk of gambling disorder (Okuda et al., 2016) and can be under-represented within study samples; they were not focused upon within this review. Future research should examine these vulnerabilities and if they worsen during times of instability such as during a pandemic.

This mapping review found that while the overall evidence suggested reductions in gambling at the population level during earlier socially restrictive stages of the pandemic, certain vulnerable groups were likely to experience an escalation of gambling (including problematic gambling, i.e. gambling associated with harms) during this time. In particular, we noted evidence from higher quality studies of concerning exacerbations of gambling amongst young adults, and in those with a prior history of at-risk gambling or gambling disorder. As such, it is likely that the pandemic led to an exacerbation of gambling-related harms in these vulnerable groups, which would be overlooked if public health providers, governments, and other stakeholders simply acknowledge ‘top line’ population level summary statistics (or evidence syntheses). Appropriate longitudinal research is needed to address how any reported changes in gambling behaviour are moderated or exacerbated as pandemic-related restrictions lift across the globe. Additional support in the aftermath of a pandemic is likely to be needed for those who developed gambling disorder, as well as for those whose pre-existing gambling disorder symptoms increased, due to the inherently addictive nature of the underlying behaviour.

Funding and disclosures

Dr. Grant has received research grants from Otsuka and Biohaven Pharmaceuticals. He receives yearly compensation from Springer

Publishing for acting as Editor-in-Chief of the Journal of Gambling Studies and has received royalties from Oxford University Press, American Psychiatric Publishing, Inc., Norton Press, and McGraw Hill. This research was funded in whole, or in part, by Wellcome [110049/Z/15/Z & 110049/Z/15/A]. For the purpose of open access, the author has applied a CC BY public copyright licence to any Author Accepted Manuscript version arising from this submission. Prof. Chamberlain’s and Dr Quinn’s role in this study was funded by a Wellcome Trust Clinical Fellowship (110049/Z/15/Z & 110049/Z/15/A). Prof. Chamberlain receives honoraria from Elsevier for editorial work.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.neubiorev.2022.104932](https://doi.org/10.1016/j.neubiorev.2022.104932).

References

- Abacus Data, 2020. Online Gambling/ Betting: Survey Results (online). (<https://www.gra.co.ca/Modules/EvidenceCentre/Details/online-gambling-betting-a-survey-of-1-500-canadians-during-the-covid-19-pandemic>). (Accessed 2 February 2022).
- Albertella, L., Rotaru, K., Christensen, E., Lowe, A., Brierley, M.-E., Richardson, K., Chamberlain, S.R., Lee, R.S.C., Kayayan, E., Grant, J.E., Schluter-Hughes, S., Ince, C., Fontenelle, L.F., Segrave, R., Yucel, M., 2021. The influence of trait compulsivity and impulsivity on addictive and compulsive behaviors during COVID-19. *Front. Psychiatry* 2021 Feb 23 (12), 634583. <https://doi.org/10.3389/fpsy.2021.634583>.
- Alessi, M.C., Martinotti, G., De Berardis, D., Sociali, A., Di Natale, C., Sepede, G., Cheffo, D.P.R., Monti, L., Casella, P., Pettorruso, M., Sensi, S., Di Giannantonio, M., 2022. Craving variations in patients with substance use disorder and gambling during COVID-19 lockdown: the Italian experience. *World J. Clin. Cases* 10 (3), 882–890. <https://doi.org/10.12998/wjcc.v10.i3.882>.
- Aslan, E.A., Kilincel, O., 2021. The effect of social isolation on psychological stress and gambling in the COVID-19 pandemic. *Ann. Clin. Anal. Med.* 12 (1), 30–35. <https://doi.org/10.4328/ACAM.20390>.
- BBC News, 2020. Coronavirus: I Play Computer Games for Hours Each Day (Online). (<https://www.bbc.com/news/business-52110990>).
- Bellringer, M.E., Garrett, N., 2021. Risk factors for increased online gambling during COVID-19 Lockdowns in New Zealand: a longitudinal study. *Int. J. Environ. Res. Public Health* 18, 12946. <https://doi.org/10.3390/ijerph182412946>.
- Biddle, N., 2020. Gambling During the COVID-19 Pandemic, Australia National University: Centre for Social Research & Methods.
- Black, N., Swanton, T.B., Burgess, M.T., Gainsbury, S.M., 2021. Impact of gambling supply reduction during COVID-19 shutdowns on gambling problems and gambling behaviour in Australia: a national longitudinal study. *J. Gambl. Stud.* <https://doi.org/10.1007/s10899-021-10067-6>.
- Brodeur, M., Audette-Chapdelaine, S., Savard, A.C., Kairouz, S., 2021. Gambling and the COVID-19 pandemic: a scoping review. *Prog. Neuropsychopharmacol. Biol. Psychiatry* 111, 1–14. <https://doi.org/10.1016/j.pnpbp.2021.110389>.
- Brown, R., Hickman, A., 2020. Changes in online gambling during the COVID-19 pandemic: April update. *Statistical Bulletin* no.27, Australian Institute of Criminology, Canberra. <https://doi.org/10.52922/sb04626>.
- Chamberlain, S.R., Stochl, J., Redden, S.A., Odlaug, B.L., Grant, J.E., 2017. Latent class analysis of gambling subtypes and impulsive/compulsive associations: time to rethink diagnostic boundaries for gambling disorder? *Addict. Behav.* 72, 79–85. <https://doi.org/10.1016/j.addbeh.2017.03.020>.
- Donati, M.A., Cabrini, S., Capitanucci, D., Primi, C., Smaniotto, R., Avanzi, M., Quadrelli, E., Bielli, G., Casini, A., Roaro, A., 2021. Being a gambler during the COVID-19 pandemic: a study with Italian patients and the effects of reduced exposition. *Int. J. Environ. Res. Public Health* 18 (2), 424. <https://doi.org/10.3390/ijerph18020424>.
- Economou, M., Souliotis, K., Malliori, M., Peppou, L.E., Kontoangelos, K., Lazaratou, H., Anagnostopoulos, D., Golna, C., Dimitriadis, G., Papadimitriou, G., Papageorgiou, C., 2019. Problem gambling in Greece: prevalence and risk factors during the financial crisis. *J. Gambl. Stud.* 35 (4), 1193–1210. <https://doi.org/10.1007/s10899-019-09843-2>.
- Eden, J., Levit, L., Berg, A., Morton, S., 2011. *Finding What Works in Health Care: Standards for Systematic Reviews*. The National Academic Press, Washington DC.
- Emond, A., Nairn, A., Collard, S., Hollén, L., 2022. Gambling by young adults in the UK during COVID-19 lockdown. *J. Gambl. Stud.* 38, 1–13. <https://doi.org/10.1007/s10899-021-10029-y>.
- Fluharty, M., Fancourt, D., 2021. How have people been coping during the COVID-19 pandemic? Patterns and predictors of coping strategies amongst 26, 016 UK adults. *BMC Psychol.* 9 (1), 107. <https://doi.org/10.1186/s40359-021-00603-9>.
- Fontenelle, L.F., Albertella, L., Brierley, M.E., Thompson, E.M., Destree, L., Chamberlain, S.R., Yucel, M., 2021. Correlates of obsessive-compulsive and related disorders symptom severity during the COVID-19 pandemic. *J. Psychiatr. Res.* 143, 471–480. <https://doi.org/10.1016/j.jpsychires.2021.03.046>.
- Fontenelle, L.F., Miguel, E.C., 2020. The impact of coronavirus (COVID-19) in the diagnosis of obsessive-compulsive disorder. *Depress Anxiety* 37 (6), 510–511. <https://doi.org/10.1002/da.23037>.

- Gainsbury, S.M., Swanton, T.B., Burgess, M.T., Blaszczynski, A., 2021. Impacts of the COVID-19 shutdown on gambling patterns in Australia: consideration of problem gambling and psychological distress. *J. Addict. Med.* 15 (6), 468–476. <https://doi.org/10.1097/ADM.0000000000000793>.
- Georgiadou, E., Müller, A., Koopmann, A., Leménager, T., Hillemacher, T., Kiefer, F., 2021. Changes in gambling behavior during the COVID-19 lockdown in Germany. *Int. Gambl. Stud.* <https://doi.org/10.1080/14459795.2021.1956562>.
- GOV.UK, 2022. PM Statement on Living With COVID: 21 February 2022. (Online). (<http://www.gov.uk/government/speeches/pm-statement-on-living-with-covid-21-february-2022>).
- Grant, M.J., Booth, A., 2009. A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Inf. Libr. J.* 26, 91–108. <https://doi.org/10.1111/j.1471-1842.2009.00848.x>.
- Gunstone, B., Gosschalk, K., Joyner, O., Diaconu, A., Sheikh, M., 2020. The Impact of the COVID-19 Lockdown on Gambling Behaviour, Harms and Demand for Treatment and Support (Online). (<https://about.gambleaware.org/media/2284/yougov-covid-19-report.pdf>). (Accessed 2 February 2022).
- Håkansson, A., 2020a. Changes in gambling behavior during the COVID-19 pandemic – a web survey study in Sweden. *Int. J. Environ. Res. Public Health* 17, 4013. <https://doi.org/10.3390/ijerph17114013>.
- Håkansson, A., 2020b. Impact of COVID-19 on online gambling – a general population survey during the pandemic. *Front. Psychol.* <https://doi.org/10.3389/fpsyg.2020.568543>.
- Håkansson, A., 2021. Gambling and self-reported changes in gambling during COVID-19 in web survey respondents in Denmark. *Heliyon*, e07506.
- Håkansson, A., Fernandez-Aranda, F., Jimenez-Murcia, S., 2021. Gambling-like day trading during the COVID-19 pandemic- need for research on a pandemic – related risk of indebtedness and mental health impact. *Front. Psychiatry* 12.
- Håkansson, A., Fernandez-Aranda, F., Menchon, J.M., Potenza, M.N., Jimenez-Murcia, S., 2020a. Gambling during the COVID-19 crisis – a cause for concern. *J. Addict. Med.* 14 (4), e10–e12. <https://doi.org/10.1097/ADM.0000000000000690>.
- Håkansson, A., Jönsson, C., Kenttä, G., 2020b. Psychological distress and problem gambling in elite athletes during COVID-19 restrictions—a web survey in top leagues of three sports during the pandemic. *Int. J. Environ. Res. Public Health* 17 (18), 6693. <https://doi.org/10.3390/ijerph17186693>.
- Håkansson, A., Widinghoff, C., 2020. Over-indebtedness and problem gambling in a general population sample of online gamblers. *Front. Psychiatry* 11 (7). <https://doi.org/10.3389/fpsyg.2020.00007>.
- Hampshire, A., Hellyer, P.J., Soreq, E., Mehta, M.A., Ioannidis, K., Trender, W., Grant, J. E., Chamberlain, S.R., 2021. Associations between dimensions of behaviour, personality traits, and mental health during the COVID-19 pandemic in the United Kingdom. *Nat. Commun.* 12, 4111. <https://doi.org/10.1038/s41467-021-24365-5>.
- Health Promotion Agency, (2020a) The Impact of Lockdown on Health Risk Behaviours (Online) (<https://www.hpa.org.nz/research-library/research-publications/the-impact-of-lockdown-on-health-risk-behaviours>). (Accessed 2 February 2022).
- Health Promotion Agency, 2020b. Post-Lockdown Survey – the Impact on Health Risk Behaviours (Online). (<https://www.hpa.org.nz/research-library/research-publications/post-lockdown-survey-the-impact-on-health-risk-behaviours>). (Accessed 2 February 2022).
- Hodgins, D.C., Stevens, R.M.G., 2021. The impact of COVID-19 on gambling and gambling disorder: emerging data. *Curr. Opin. Psychiatry* 34 (4), 332–343. DOI: [10.1097/YCO.0000000000000709](https://doi.org/10.1097/YCO.0000000000000709).
- Homer, A., 2020. Online Casino Searches at “all-time high” During Lockdown (Online). (<https://www.bbc.co.uk/news/uk-england-52633355>).
- Institute for Government, 2022. Timeline of UK Government Coronavirus Lockdowns and Measures, March 2020 to December 2021 (Online). (<https://www.instituteforgovernment.org.uk/charts/uk-government-coronavirus-lockdowns>).
- Jenkinson, R., Sakata, K., Khokhar, T., Tajin, R., Jatkar, U., 2020. Gambling in Australia During COVID-19, Australian Gambling Research Centre, Melbourne, Victoria.
- King, D.L., Delfabbro, P.H., Billieux, J., Potenza, M.N., 2020. Problematic online gaming and the COVID-19 pandemic. *J. Behav. Addict.* 9 (2), 184–186. <https://doi.org/10.1556/2006.2020.00016>.
- Lischer, S., Steffen, A., Schwarz, J., Mathys, J., 2021. The influence of lockdown on the gambling pattern of Swiss casino players. *Int. J. Environ. Res. Public Health* 18 (4). <https://doi.org/10.3390/ijerph18041973>.
- Lugo, A., Stival, C., Paroni, L., Amerio, A., Carrera, G., Gorini, G., Mastrobattista, Minutillo, A., Mortali, C., Odone, A., Pacifici, R., Tinghino, B., Gallus, S., 2021. The impact of COVID-19 lockdown on gambling habit: a cross-sectional study from Italy. *J. Behav. Addict.* 10 (3), 711–721. <https://doi.org/10.1556/2006.2021.00033>.
- Maraz, A., Katzinger, E., Yi, S., 2021. Potentially addictive behaviours increase during the first six months of the COVID-19 pandemic. *J. Behav. Addict.* <https://doi.org/10.1556/2006.2021.00079>.
- National Gambling Impact and Policy, 1999. National Gambling Impact Study Commission: Final Report, National Gambling Impact Study Commission, Washington, D.C.
- Okuda, M., Liu, W., Cisewski, J.A., Segura, L., Storr, C.L., Martins, S.S., 2016. Gambling disorder and minority populations: prevalence and risk factors. *Curr. Addict. Rep.* 3 (3), 280–292. <https://doi.org/10.1007/s40429-016-0108-9>.
- Petticrew, M., Roberts, H., 2006. *Systematic Reviews in the Social Sciences: a Practical Guide*. Blackwell Publishing, Oxford.
- Price, A., 2020. Online gambling in the midst of COVID-19: a nexus of mental health concerns, substance use and financial stress. *Int. J. Ment. Health Addict.* 20, 362–379. <https://doi.org/10.1007/s11469-020-00366-1>.
- Price, A., Tabri, N., Stark, S., Balodis, I.M., Wohl, M.J.A., 2022. Mental health over time and financial concerns predict change in online gambling during COVID-19. *Int. J. Ment. Health Addict.* <https://doi.org/10.1007/s11469-021-00750-5>.
- Price, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Salmseer, L., Tetzlaff, J.M., Akl, E.A., Brennan, S.E., Chou, R., Ganville, J., Grimshaw, J.M., Hrobjartsson, A., Lalu, M.M., Li, T., Loder, E.W., Mayo-Wilson, E., McDonald, S., McGuinness, L.A., Stewart, L.A., Thomas, J., Tricco, A.C., Welch, V.A., Whiting, P., Moher, D., 2021. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021, 372. <https://doi.org/10.1136/bmj.n71>.
- Public Health England, 2021. The Impact of COVID-19 on Gambling Behaviour and Associated Harms: a Rapid Review (Online). (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1020748/Gambling_review_COVID_report.pdf).
- Rantis, K., Panagiotidis, P., Parlapani, E., Holvea, V., Tsapakis, E.M., Diakogiannis, I., 2021. Substance use during the COVID-19 pandemic in Greece. *J. Subst. Use.* <https://doi.org/10.1080/14659891.2021.1941344>.
- Sachdeva, V., Sharma, S., Sarangi, A., 2021. Gambling behaviors during COVID-19: a narrative review. *J. Addict. Dis.* 17, 1–9. <https://doi.org/10.1080/10550887.2021.1971942>.
- Salerno, L., Pallanti, S., 2021. COVID-19 related stress in gambling disorder. *Front. Psychiatry* 12, 620661. <https://doi.org/10.3389/fpsyg.2021.620661>.
- Sharman, S., Roberts, A., Bowden-Jones, H., Strang, J., 2021a. Gambling and COVID-19: initial findings from a UK sample. *Int. J. Ment. Health Addict.* 4, 1–12. <https://doi.org/10.1007/s11469-021-00545-8>.
- Sharman, S., Roberts, A., Bowden-Jones, H., Strang, J., 2021b. Gambling in COVID-19 Lockdown in the UK: depression, stress, and anxiety. *Front. Psychiatry* 12, 621497. <https://doi.org/10.3389/fpsyg.2021.621497>.
- Shaw, C.A., Hodgins, D.C., Williams, R.J., Belanger, Y.D., Christensen, D.R., el-Guebaly, N., McGrath, D.S., Nicoll, F., Smith, G.J., Stevens, R.M.G., 2021. Gambling in Canada during the COVID lockdown: prospective national survey. *J. Gambl. Stud.* <https://doi.org/10.1007/s10899-021-10073-8>.
- Sue, V.M., Ritter, L.A., 2012. *Conducting Online Surveys*, Second ed., Sage, Thousand Oaks, California.
- Survation, 2020. Covid-19: Survation Survey for Clean Up Gambling Campaign Points to Addiction Concerns During Coronavirus Lockdown (Online). (<https://www.survation.com/covid-19-survation-survey-for-clean-up-gambling-campaign-points-to-addiction-concerns-during-coronavirus-lockdown/>). (Accessed 2 February 2022).
- Wardle, H., Critchlow, N., Donachie, C., Brown, A., Hunt, K., 2021. Betting and Gambling COVID-19 Impact Study, University of Stirling, Stirling. (<https://www.stir.ac.uk/research/public-policy-hub/policy-briefings/>).
- Woodruff, C., Gregory, S., 2005. Profile of internet gamblers: betting on the future. *UNLV Gaming Res. Rev. J.* 9 (1), 1–14.
- Xuereb, S., Hyoun, S.K., Clark, L., Wohl, M.J.A., 2021. Substitution behaviours among people who gamble during COVID-19 precipitated casino closures. *Int. Gambl. Stud.* 21 (3), 411–425. <https://doi.org/10.1080/14459795.2021.1903062>.
- Zamboni, L., Carli, S., Belleri, M., Giordano, R., Saretta, G., Lugoboni, F., 2021. COVID-19 lockdown: impact on online gambling, online shopping, web navigation and online pornography. *J. Public Health Res.* 10, 1959. <https://doi.org/10.4081/jphr.2021.1759>.