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Gambling and Gaming in the United Kingdom during the COVID-19 Lockdown

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Abstract: During the first UK national COVID-19 lockdown, there were fears that increased online gaming and gambling could negatively impact wellbeing. Using a cross-sectional retrospective change survey of 631 UK adult gamers and/or gamblers during the week the UK lockdown was partially lifted (June 2020), we investigated participation in gaming/gambling and relationships with problem gaming, problem gambling and wellbeing (using the following previously validated scales: the Internet Gaming Disorder Short Form; a short-form version of the Problem Gambling Severity Index; a short-form of the Warwick–Edinburgh Mental Well-Being Scale). Results indicated a near-doubling in gaming activity during lockdown and significant increases in problem gaming scores, but not in numbers of disordered gamers. Aggregate changes to gambling participation and problem gambling were negligible: decreases in offline and sports gambling were balanced by increases in online gambling. Wellbeing scores decreased during lockdown across the sample, particularly amongst women, and path analysis revealed moderate correlations between increases in problem gaming and gambling scores and reductions in wellbeing. We conclude that for some, maladaptive gaming/gambling coping strategies during the lockdown may have exacerbated its negative effects.

Keywords: gambling; problem gambling; video gaming; COVID-19; wellbeing

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1. Introduction

The first COVID-19 UK lockdown, commencing March 2020, imposed major restrictions on the movements of UK citizens. It was expected to severely damage the UK economy [1], precipitate job losses [2], and worsen mental health and suicide rates [3].

Leisure, in general, is an important and effective means of coping with stress [4]. Given that many UK citizens gained additional 'free time' during lockdown—through job losses, furlough, or home-working (i.e., without the usual commute)—leisure-based coping offered a potential means of stress management. However, the availability of leisure activities declined dramatically: the restrictions rendered many pastimes inaccessible, thus driving increased domestic (i.e., home-based) leisure activities [5].

Video gaming and online gambling—already popular in the UK [6,7]—increased substantially at the onset of lockdown. With video gaming, game download volume in Europe reached a record high [8]. With gambling, UK Internet searches for online slots increased twenty-fold [9], and international online real-money poker traffic doubled [10].

Rather than being regarded as a benign form of leisure-based coping, the rise in online gambling generated apprehension from academics [11] and the UK government's Department for Digital, Culture, Media and Sport expressed "concerns that the current

social distancing measures could lead to an increase in problem gambling online" [12]. There is theoretical support for such concerns. Disordered gambling has been linked with both stress (Buchanan et al., 2020) and stressful life events [13], and gambling as an 'escape' from negative moods has been linked both qualitatively [14] and quantitatively [15] with an increased risk of problematic gambling.

Similar fears may apply to video gaming. Problematic video gaming (or 'internet gaming disorder'; IGD) has been characterised by the World Health Organisation as impaired control over gaming, increasing precedence/priority over other activities, and escalation of gaming despite the occurrence of negative consequences. Similar to gambling, escape or coping motives have also been linked with IGD [16], especially for those experiencing stress [17] or having difficulty regulating emotions [18]. Harms from over-involvement in gaming can encompass both psychosocial harms and financial harms. Psychosocial harms may involve neglecting responsibilities or experiencing relationship issues [19]. With financial harms, there is a wide array of game-related purchasable products and services available, including chance-based items ('loot boxes')—which are known to be purchased more frequently by those with symptoms of both disordered gaming [20] and gambling [21].

The evidence for such gaming-related harms, however, is almost exclusively cross-sectional [16]—and conversely, some research has actually demonstrated that gaming might play a beneficial role in managing stress [22]. At the onset of the pandemic, some academic commentators therefore highlighted the potential for both the harms and benefits that might derive from increased gaming [23].

To understand how the COVID-19 lockdown influenced engagement with gaming and gambling, potential impacts on problematic gaming/gambling, and any associations with mental health and wellbeing, we conducted a cross-sectional survey of gamers and gamblers. This was conducted as the UK was starting to lift the first national lockdown (early June 2020), using retrospective change questions [24] enquiring about these activities both before and during lockdown. We expected to see increases in engagement, including symptoms of problematic engagement, particularly amongst those reporting poorer well-being. Our findings are contextualised, in the discussion, within a burgeoning literature on the psychosocial impacts of gaming and gambling during the lockdown—where our survey remains a rare example that concurrently investigates both leisure activities.

2. Materials and Methods

2.1. Sample

Our study utilised a sample from Prolific Academic [25], targeting players of both video and gambling games by utilising existing pre-screening criteria (i.e., already available on Prolific Academic) for gaming-related hobbies that covered video games, mobile games, esports and gambling. The sample (via the Prolific Academic targeting service) was demographically representative of the UK for age, sex and ethnicity, and we targeted a final sample of 700 participants. Participants gave informed consent before completing the survey. The study was approved by the University of Plymouth Faculty Research Ethics and Integrity Committee (approved 1 May 2020; reference 19/20-1219).

2.2. Survey Tools

In addition to a standard demographic questionnaire, our online survey utilised previously validated scales for gaming, gambling and wellbeing. This included the Internet Gaming Disorder Short Form (IGD-SF9; referred to below as the "IGD") problem gaming scale [26]; a 3-item version of the Problem Gambling Severity Index ("PGSI" below), used in the annual Gambling Commission survey of gamblers, and established as a reasonable proxy for the full version of the PGSI [27]; the 7-item Short Warwick–Edinburgh Mental Well-Being Scale (SWEMWBS; referred to below as "WEMWBS" or, more simply, as an index of "wellbeing"), which correlates well with the longer version, but with measurement advantages (i.e., brevity combined with robust psychometric properties) for monitoring

mental wellbeing in general populations [28,29]; and an adapted version of gambling activities questionnaire from the annual Gambling Commission survey of gamblers [30]. For our adapted version of the gambling activities questionnaire, we made a small number of minor alterations to align the survey with the requirements of this study: the addition of an eSports category; a clearer separation of online/offline activities; and collapsing some responses to decrease response burden.

All the survey tools and questionnaires above were adapted for our survey using retrospective change questions [24] to capture differences in reported behaviour before and during the COVID-19 lockdown, e.g., questions were asked in a format of "in the period before lockdown" and "in the period since lockdown started". The survey was administered in the first week of June, aligning with the period when the UK government started to announce gradual easing of lockdown restrictions. It was conducted on the Qualtrics platform (www.qualtrics.com/uk, accessed on 14 December 2021), with skip logic utilised, so that gamblers only responded to gambling questions; gamers responded only to gamer questions; and dual gamers/gamblers responded to all questions.

Data integrity was maximised by several approaches, with responses being removed if they failed to correctly answer an attention check question (i.e., "In order to check the reliability of your responses, please select 'Once a month' as the answer to this question"). Similarly, if respondents IP addresses were duplicate or Qualtrics-generated 'RecaptchaScore' were below the suggested cut-off of 0.5, data were manually checked and removed if non-genuine (e.g., duplicate responses and evidence of auto-filling questionnaire)

2.3. Statistical Analysis

2.3.1. Changes to Gaming and Gambling Activities

All data analyses were conducted in R [31]. For presentation of results and significance tests, overall gaming and gambling activity were converted from categorical data (e.g., response codes for daily gaming activity were categories of: 1–2 h; 3–4 h; 5–6 h; 7–8 h; 8+ h) into numeric data, taking the mid-point of the category as the response (8+ h was coded conservatively; as 8 h), before means were calculated. For the aggregate percentage weekly gambling activities (overall, offline and online), we calculated the percentage of participants engaging in each type of gambling activity at least once per week, as a proportion of all participants who gambled. Online and offline gambling activities were aggregated by calculating the percentage of participants who engaged in any type of gambling in each category (i.e., online or offline) at least once a week, as a percentage of all participants who gambled. These values were compared before and after lockdown for aggregate changes. With video gaming, we also asked respondents for their mean monthly spend on both non-randomised and randomised "loot box" game-related purchases, both before and during lockdown.

For changes in gaming and gambling activities and mean instrument scores (i.e., PGSI, IGD and WEMWBS), significance was tested using Wilcoxon signed rank test (due to violations of normality). In relevant tables (see results), significant results at $p < 0.01$ are indicated; with results Bonferroni adjusted for number of tests within each table/test set. For changes to mean instrument scores (i.e., PGSI and IGD), significance was tested using Wilcoxon signed rank tests.

2.3.2. Changes to Wellbeing

To investigate the effect of demographic variables on changes in wellbeing scores (as measured by WEMWBS-SF), we utilised two-way repeated-measures ANOVA. With ethnicity demographics, we simplified ethnicity from the original Office of National Statistics (ONS) codes, due to high number of official ONS categories. These reduced categories simplified the quantitative analysis (see Table 1 for the simplified codes). Age variables were binned into decades. Although the data were not normally distributed, a two-way repeated-measures ANOVA was used, as this test is known to be robust against violations of normality, particularly when the sample size is sufficiently large [32,33]. Please note

that whilst data transformations were attempted (i.e., to normalise data), these did not yield normalised residuals or substantially different results (data not shown). Analysis was conducted using the 'rstatix' package in R.

Table 1. Demographic information about survey respondents. Marital status, income and educational level were also available; data not shown.

Demographics *n* = 631		
Media Age (SD)	45.28 (15.33)	
Gender F (% Female)	319	50.55%
Ethnicity:		
White	521	82.57%
Black/African/Caribbean/Black British	26	4.12%
Asian/Asian British	47	7.45%
Mixed/Multiple ethnic groups	20	3.17%
Other ethnic group	15	2.38%
Occupation:		
Full-time education	31	4.91%
Full-time employee furloughed during lockdown	42	6.66%
Full-time employee	233	36.93%
Looking after the home/family	64	10.14%
Other/Prefer not to answer	77	12.20%
Part-time employee furloughed during lockdown	21	3.33%
Part-time employee (<30 h/week)	56	8.87%
Seeking opportunities/work	38	6.02%
Self-employed	69	10.94%
Gamers/Gamblers		
% Plays video games	465	73.69%
% Gambled	449	71.16%
Both gambled and played games	283	44.85%

2.3.3. Path Analysis of Problem Gaming, Problem Gaming and Wellbeing over Time

To investigate whether longitudinal changes in PGSI and IGD scores (i.e., before and after the start of lockdown) were predictive of comparable changes in WEMWBS scores, we conducted a multivariate autoregressive path analysis on the scores for all three measures (before and during lockdown). Analysis was conducted using the Lavaan package in R. All three sets of scores were analysed within the confines of a single autoregressive path model (see Figure 1), a procedure that accounts for differences in measurement variance at each time point (i.e., pre versus post-lockdown).

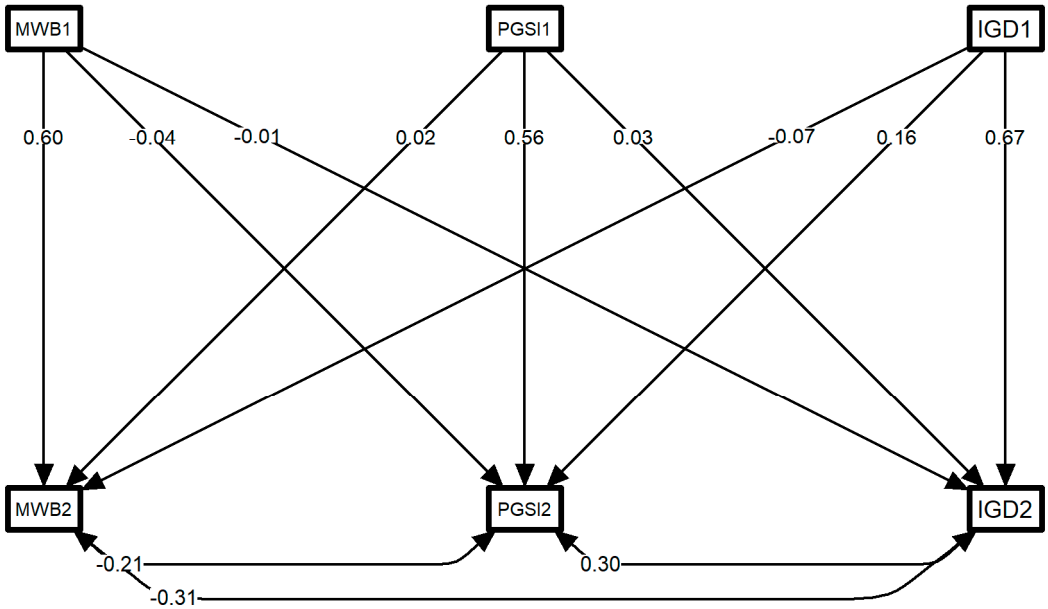

Figure 1. Diagram of path analysis model, including betas. Top nodes show WEMWBS, PGSI and IGD before lockdown (MWB1, PGB1 and IGB1). Bottom three nodes show these measures after lockdown (MWB2, PGB2 and IGB2). Arrows between bottom nodes represent the three key relationships, i.e., how these variables correlate with each other after lockdown, once correlation before lockdown has been accounted for.

3. Results

3.1. Demographics and Participation Rates

We received 692 completed responses, all of which passed data integrity checks, including 'recaptcha' bot check (4 low-scoring responses were confirmed as legitimate after manual checks); duplicate IP addresses (7 duplicate pairs confirmed as legitimate after manual checks, i.e., responses were husband–wife dyads, etc.); and dummy question (all responses correct).

Whilst we targeted gamers and gamblers (with pre-screen questions), a total of 61 participants were no longer actively gaming/gambling, and were therefore removed from our cohort, leaving a cohort of 631 participants who were either current gamers, gamblers, or both. Demographics are shown in Table 1, which are representative of the UK for age, gender and ethnicity [34], and approximately representative of percentage of employees furloughed during the lockdown [35,36].

3.2. Gaming and Problem Gaming during the COVID-19 Lockdown

From our cohort of 465 active video game players, our results confirm a significant increase in computer gaming during lockdown (Table 2). The mean days played per week increased from 2.35 to 3.8; this translates as an almost doubling of the number of players playing every day of the week (increasing from 22.8% to 43.4%). Similarly, the mean hours played per day almost doubled, from 1.54 to 2.8 h; with the number of players playing 3+ h per day more than doubling (from 19.78% to 53.76%).

Table 2. Changes to gaming behaviour during COVID-19 lockdown. Top panel: Key gaming measures before and after lockdown. The final column shows net change, with significance ($p < 0.01$; Bonferroni adjusted) indicated by an asterisk. Bottom panel: Item-by-item results for IGD. Individual items scored from 1 to 5; 1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = very often. Item names are indicative; for full item wording, see: https://www.halleypontes.com/igds9sf, accessed on 14 December 2021.

	Before Lockdown	**After Lockdown**	**Change (* = $p < 0.01$)**
Mean days played per week	2.35	3.80	1.45 *
Mean hours played per day	1.54	2.80	1.26 *
Mean in-app purchase monthly spend (n = 127)	£6.05	£18.40	£12.36 *
Mean loot box monthly spend (n = 28)	£5.87	£32.36	£26.48 *
Mean risky loot box index score	15.61	17.89	2.29
Mean IGD score	13.40	15.25	1.85 *
Mean IGD scores, item-by-item			
Preoccupation	1.77	2.25	0.48 *
Irritability	1.38	1.57	0.20 *
Time	1.60	1.94	0.34 *
Loss of control	1.35	1.51	0.16 *
Loss of interest	1.48	1.77	0.30 *
Continued gaming	1.29	1.35	0.06
Deception	1.14	1.18	0.05
Escape	2.29	2.56	0.27 *
Jeopardised job/relationship	1.10	1.11	0.00

Changes in gaming activity were also observed as significant increases in both in-application purchases (increasing by £12.36 per month) and loot box purchasing (increasing by £26.48 per month), albeit with reduced numbers (127 gamers (27%) made in app-purchases; 28 gamers (6%) purchased loot boxes).

Finally, we also observed increases in problem gaming/IGD. However, in terms of 'disordered gamers,' as classified by the developers of the GD (endorsed at least five criteria out of the nine as 'very often' [37]), none of our cohort were classified as disordered gamers before lockdown, whereas two individuals (0.43% of gamers) attained this status during lockdown.

To investigate changes to problem gaming further, we also looked at results on an item-by-item basis (Table 2; bottom panel). This revealed significant increases to the majority (6 of 9) items. Whilst these items are equally weighted for scoring purposes, significant increases were *not observed* in those items that involved 'continuing gaming until it caused problems with significant others', or 'deceiving family members and jeopardising jobs/relationships'. Thus, whilst increases in gaming caused increases in items around preoccupation, irritability and time playing, this did not appear to translate into problems with relationships or employment.

3.3. Gambling and Problem Gambling during the COVID-19 Lockdown

From our total cohort of 449 active gamblers (i.e., gambled in the last 12 months), our results reveal that before lockdown, approximately 60% gambled on a weekly basis; after lockdown, this dropped to approximately 56% gambling on a weekly basis (Table 3; top panel). The decline in gambling activities (not statistically significant) was primarily driven by a large drop in sports betting. Before lockdown, this was the second most popular

gambling activity (after the national lottery), but during lockdown all Western European sports, including England's premier league, were halted. The drop in gambling activities was further exacerbated by an almost complete (and statistically significant) cessation of offline gambling activities (only one individual, confirmed via personal message, was able to access an offline gambling machine).

Table 3. Changes to gambling behaviour during COVID-19 lockdown. Top panel: Changes to gambling activities—where 'overall weekly gamblers,' 'offline gamblers' and 'online gamblers' is the percentage of participants engaging in all types of individual gambling activity (as listed in middle panel) at least once per week; significant changes ($p < 0.01$) are indicated with an asterisk. Middle panel: Changes to individual gambling activities; p-values are Bonferonni adjusted. Bottom panel: Changes to mean PGSI scores; and corresponding numbers of problem, moderate-risk, low-risk and non-problem gamblers in our gambling cohort.

	Before Lockdown	**After Lockdown**	**Change (* = $p < 0.01$)**	**Online/ Offline**
Gambling Activities (% gamble every week)				
Overall Weekly Gamblers	60.36%	56.12%	−4.23%	
Offline Gamblers	5.79%	0.22%	−5.57% *	
Online Gamblers	16.93%	21.16%	4.23%	
Individual Gambling Activities (% gamble every week)				
Lottery	36.97%	38.31%	1.34%	Both
Scratchcards	9.80%	9.58%	−0.22% *	Both
Online Instant Wins	3.34%	5.12%	1.78%	Online
Offline Fruit Machines	2.90%	0.22%	−2.67% *	Offline
Online Fruits and Slots	8.46%	11.58%	3.12%	Online
Offline Gaming Machines	3.12%	0.00%	−3.12% *	Offline
Offline Bingo	1.34%	0.00%	−1.34% *	Offline
Online Bingo	4.90%	5.79%	0.89%	Online
Sports	21.83%	13.36%	−8.46% *	Both
Virtual Sports	1.78%	2.23%	0.45%	Online
eSports	0.67%	0.89%	0.22%	Online
Politics Other Events	0.45%	0.45%	0.00%	Both
Offline Casino	0.89%	0.00%	−0.89% *	Offline
Online Casino	4.23%	6.46%	2.23%	Online
Private Betting	1.34%	3.34%	2.00% *	Both
Other	4.45%	5.35%	0.89%	Both
PGSI: Mean Score	0.57	0.49	−0.08	
Problem Gambler Status				
Non Problem Gamblers	310	321	11	
Low Risk Gamblers	82	71	−11	
Moderate Risk	43	47	4	
Problem Gambler	14	10	−4	

However, these drops in gambling activities were counterbalanced by a (non-significant) increase in all online gambling activities, with an increase of approximately 4% of individuals gambling online on a weekly basis. (In Table 3, aggregate changes in offline/online gambling do not match changes to overall gambling—this is because overall gambling includes additional activities that are not-specific to online/offline, such as bingo, scratchcards and private betting.)

These moderate drops in gambling activities, largely driven by lack of sports/offline gambling, appear to have driven a moderate drop in mean PGSI scores, which was not statistically-significant (Table 3; bottom panel). This translated to a corresponding drop in the numbers of problem gamblers and low-risk gamblers within our cohort.

3.4. Wellbeing during the COVID-19 Lockdown—Interactions with Demographics, Gaming and Gambling

To investigate how demographic, gaming and gambling variables changed with time, we conducted a repeated-measures ANOVA. Across the cohort of 631 gamers/gamblers, wellbeing scores (as measured by the WEMWBS) before lockdown were similar to UK norms [38], but over lockdown dropped by approximately 2 points (Table 4). This is generally accepted to represent a statistically and clinically meaningful drop [39]. The repeated-measures ANOVA established a significant difference between these times ($p < 0.001$), with a medium effect size ($\eta^2[g] = 0.062$).

Table 4. Repeated-measures ANOVA of changes to WEMWBS, before and during the COVID-19 lockdown. Results of two-way repeated-measures ANOVA to test the interaction of demographic (top panel), gaming (middle panel) and gambling (bottom panel) variables with time. The mean WEMWBS scores for each population are shown before lockdown, during lockdown, and with aggregate change, with significant differences (from repeated-measures ANOVA) indicated by asterisk. Results of ANOVA, with *p* values and generalised eta squared (ges), are in final two columns.

Variable	Population	*n*	WEMWBS-SF			ANOVA	
			Before	After	Change	*p*	ges
Time	Full cohort	631	23.3	21.3	−2 *	1.28×10^{-42}	0.062
Sex:time	F	319	23.2	21	−2.2		
	M	312	23.2	21.6	−1.6 *	6.00×10^{-3}	0.002
Maritial status:time	Co-habiting with partner	115	22.9	21.1	−1.8	7.24×10^{-1}	0.000913
	Divorced/separated	43	23.3	20.9	−2.4		
	In a relationship	41	22.1	19.8	−2.3		
	Married	280	24.1	22.2	−1.9		
	Prefer not to say	7	24.3	21	−3.3		
	Single	145	22.2	20.1	−2.1		
Income:time	£10,001–£15,000	49	22.9	21.4	−1.5	2.56×10^{-1}	0.003
	£15,001– £20,000	73	22.8	21	−1.8		
	£20,001–£25,000	86	22.5	20.7	−1.8		
	£25,001–£30,000	71	23.4	20.6	−2.8		
	£30,001–£40,000	64	23.7	21.7	−2		
	Above £40,000	75	23.8	22.2	−1.6		
	Below £10,000	73	22.1	20.6	−1.5		
	Not earning	118	24.2	21.8	−2.4		
	Prefer not to answer	22	23.4	21.5	−1.9		
Ethnicity:time	Asian	47	22.8	21.5	−1.3	2.37×10^{-1}	0.002
	Black African/Caribbean	26	24.2	21.3	−2.9		
	Mixed	20	23.2	20.4	−2.8		
	Other	17	21.7	20.6	−1.1		
	White	521	23.3	21.3	−2		
Gaming							
IGDSF9 score before:time						3.12×10^{-1}	0.01
IGDSF9 score after:time						1.10×10^{-4}	0.03
Gambling							
PGSI score before:time						5.90×10^{-1}	0.006
PGSI score after:time						3.45×10^{-1}	0.003

When testing the interaction of demographic variables with time (i.e., WEMWBS scores before/during the lockdown), we found a significant two-way interaction between sex and time—with females reporting bigger drops in wellbeing, albeit of small effect size. However, no other demographic variables revealed an interaction with wellbeing over time (see Table 2 where we provide results for sex, income and ethnicity). However, other demographic variables (occupation and age; data not shown) similarly revealed no significant interactions of score with time.

When analysing gaming, there was no interaction with disordered gaming status (data not shown), but there was, however, a significant interaction with gaming scores (i.e., at scale level; see Table 3). These were, however, of relatively small effect size (ges = 0.03; where 0.01 = small, 0.06 = medium and 0.14 = large [40]). With gambling, there was no interaction of either problem gaming status (data not shown) or score (see Table 3) with time on wellbeing scores.

3.5. Path Analysis—Interactions between Gaming, Gambling and Wellbeing over Time

Finally, we conducted a path analysis. This enabled us to control for pre-existing correlations between these variables (i.e., gaming, gambling and wellbeing scores), and thus test whether *changes* in gaming or gambling score during lockdown were correlated with *changes* in wellbeing scores during lockdown. See Figure 1 for model; Table 5 for results. The strength of each correlation is reported as a beta coefficient, along with an associated confidence interval and p-value. (Due to sex-related worsening of WEMBWS during the lockdown (see Table 4), we also conducted a multiple group analysis allowing paths to vary by gender; model fit was not significantly improved and we found no substantive differences between model results; data not shown.)

Table 5. Results of path analysis Top panel: regressions, i.e., how each measure before lockdown predicts each measure after lockdown. Second panel: residual correlations, i.e., how measures correlate with each other after lockdown, once correlation before lockdown has already been accounted for. Third panel: correlations between each measure before lockdown. Fourth panel: variance of scores, at each time (n.b. fixed at 1 before lockdown to make model estimable). Bottom panel: intercepts for each of the predictors entered into the model.

Path	β (ci-low, ci-high)	p
MWBS2~MWBS1	0.60 (0.54, 0.66)	0.00
MWBS2~SI1	0.02 (−0.06, 0.10)	0.66
MWBS2~IGD1	−0.07 (−0.15, 0.01)	0.08
PGSI2~MWBS1	−0.04 (−0.11, 0.04)	0.33
PGSI2~PGSI1	0.56 (0.49, 0.63)	0.00
PGSI2~IGD1	0.16 (0.07, 0.26)	0.00
IGD2~MWBS1	−0.01 (−0.08, 0.07)	0.87
IGD2~PGSI1	0.03 (−0.06, 0.11)	0.58
IGD2~IGD1	0.67 (0.61, 0.73)	0.00
MWBS2~~PGSI2	−0.21 (−0.30, −0.12)	0.00
MWBS2~~IGD2	−0.31 (−0.39, −0.23)	0.00
PGSI2~~IGD2	0.30 (0.20, 0.40)	0.00
MWBS1~~PGSI1	−0.24 (−0.32, −0.15)	0.00
MWBS1~~IGD1	−0.32 (−0.40, −0.24)	0.00
PGSI1~~IGD1	0.34 (0.24, 0.44)	0.00
MWBS2~~MWBS2	0.61 (0.55, 0.67)	0.00
PGSI2~~PGSI2	0.58 (0.51, 0.65)	0.00
IGD2~~IGD2	0.54 (0.47, 0.60)	0.00
MWBS1~~MWBS1	1.00 (1.00, 1.00)	NA
PGSI1~~PGSI1	1.00 (1.00, 1.00)	NA
IGD1~~IGD1	1.00 (1.00, 1.00)	NA

Table 5. *Cont.*

Path	β (ci-low, ci-high)	p
MWBS2~1	1.99, (1.39, 2.58)	0.00
PGSI2~1	−0.06 (−0.68, 0.57)	0.86
IGD2~1	0.69 (0.13, 1.24)	0.02
MWBS1~1	6.10 (5.76, 6.45)	0.00
PGSI1~1	0.52 (0.42, 0.62)	0.00
IGD1~1	3.19 (2.96, 3.41)	0.00

A number of observations can be made from the path analysis. First, it indicates that all three measures were significantly associated with each other before lockdown (Table 5, third panel)—with both PGSI and IGD being negatively related to WEMWBS. Second, each measure was (unsurprisingly) autocorrelated with itself, e.g., scores before lockdown were significantly predictive of the same score after lockdown (Table 5, top panel). More interestingly, IGD before lockdown was significantly predictive of PGSI after lockdown ($\beta = -0.31$, $p < 0.001$); but the reverse relationship is not true (i.e., PGSI before lockdown did not predict IGD after). This suggests that some higher-scoring IGD gamers may have migrated towards problematic gambling behaviours during lockdown; but not the reverse. Finally, and most importantly, increases in both PGSI and IGD scores during lockdown were negatively related to changes in wellbeing scores (for PGSI, $\beta = -0.21$, $p < 0.001$; for IGD, $\beta = -0.31$, $p < 0.001$).

4. Discussion

In our UK-based survey, with a sample representative for sex, age and ethnicity, we observed an aggregate wellbeing reduction during lockdown that was statistically and clinically meaningful [39]. This was consistent across all demographic variables, although more acute amongst females—an observation consistent with a concurrent population survey [41].

4.1. Video Gaming during Lockdown

We observed significant increases in the frequency and duration of gaming during lockdown. Such findings are consistent with other recent literature, where similar surveys have assessed the impact of lockdown on gaming-related activities in a number of cohorts, including Chinese children and adolescents [42], Italian adult gamers [43] and Indian college students [44].

We also observed significant increases in mean IGD scores during lockdown. However, there was not a significant rise in number of people scoring above suggested thresholds for problem gaming 'caseness' [37]. Furthermore, when examining the IGD on an item-by-item basis, changes to IGD scores were primarily driven by items relating to preoccupation, irritability, time playing, escape and loss of interest/control. In contrast, items relating to employment and familial relationships did not exhibit significant increases, suggesting that increased gaming during the pandemic may have had a limited impact on work and family life.

Nonetheless, increases in IGD scores were correlated with reductions in wellbeing scores over lockdown. Other recent findings highlight the complexity of the relationship between gaming and wellbeing during lockdown. A study of Italian gamers [43] found that the relaxation derived from gaming mediated links between distress and problematic gaming. Non-problematic gamers, playing for social enhancement, may have experienced positive benefits. In contrast, problematic gamers, playing to alleviate negative mood, may have had long-term emotional symptoms worsening during lockdown [43].

Beyond investigating wellbeing-related impacts of gaming, our study also investigated financial aspects of gaming. Here, we observed significant increases in self-reported expenditure on both non-randomised game-related purchases and also "loot boxes," which are chance-based purchases that have been linked with problem gambling [21,45]. The

observed increases were modest, where mean loot box expenditure increased by approximately £26 per month, thus implying a limited financial burden on most gamers (and corroborating data from related research [46–50]). However, previous research (with much larger datasets) has established that the distribution of loot box spend is highly skewed, with a small number of high-level spenders (i.e., £100+ per month). These individuals are overrepresented by problem gamblers and gamers [21]. Our data therefore suggest, for a limited number of individuals, the negative impacts of high-spending behaviours may be exacerbated during lockdown (our dataset only included 28 loot box purchasers; with 2 individuals spending > £100 per month after lockdown).

Our data also suggest that other types of consumer behaviour, for some, may have shifted into more negative behaviours during lockdown. Here, IGD before lockdown was significantly predictive of PGSI after lockdown; but the reverse relationship is not true (i.e., PGSI before lockdown did not predict IGD after). This suggests that some gamers scoring higher on the IGD migrated towards problem gambling behaviours during lockdown.

4.2. Gambling during Lockdown

On aggregate, changes to gambling participation and problem gambling during lockdown were negligible. Participation in online gambling was balanced by decreases in offline gambling, largely due to the cessation in professional sports and the closure of traditional gambling venues. Such findings are aligned with UK and international literature [51–57]. This effect, however, is complicated by the fact that many types of gambling are neither purely "online" or "offline", (i.e., they can be done in both contexts; see final column of Table 3), and that many gamblers have fluctuating participation in a range of gambling activities. In our dataset, a total of only seven gamblers reported having never gambled online—and thus the transition effects represent a shifting consumer behaviour, rather than an absolute transition from purely offline into purely online activities.

Similar to the lack of aggregate changes in gambling participation, we did not observe any significant changes in aggregate PGSI scores or problematic gambling status during the lockdown. However, our path analysis revealed that increases in PGSI during lockdown, when experienced, were inversely related to wellbeing. This finding is in contrast with a similar UK study, where wellbeing reductions during lockdown were unrelated to problem gambling status [58]. This contradiction is likely the result of differing methodological approaches. In both our study and the similar UK study [58], no significant differences were observed when using repeated-measures ANOVA, which uses fixed categories for problem gambling status (i.e., they are unchanging before/after lockdown). In contrast, our path analysis was employed *precisely because* it accounts for how changes in PGSI scores are related to changes in wellbeing, i.e., it is the *change* in PGSI that is related to reductions in wellbeing; not the unchanging problem gambling status.

This result therefore suggests that for some gamblers, increased problematic gambling exacerbated the negative impacts of lockdowns. Similarly, other studies have highlighted that increased gambling during lockdown may be associated with other negative outcomes, including depression and anxiety [59,60] and drinking/substance use [55,57,59,60]. This indicates that vulnerable sub-groups may be at particular risk of exacerbation of gambling-related harm during pandemics.

4.3. Strengths and Limitations

Our study design—a retrospective change survey—was necessitated by the unique, unplanned nature of the COVID-19 lockdown. Such methods, however, are not without limitations [61]. In particular, issues may arise from the recall of subjective/complex information, alongside the poorer recall of temporally distal (i.e., pre-COVID-19) information and expenditure [62]. Such effects are liable to exaggerate any post-COVID-19 increases. However, such issues with reliability are more prevalent at an individual level; less of an issue when responses are aggregated [61,63]. Furthermore, our questions followed recommendations of requiring minimal cognitive effort to enhance recall, with set anchor

points to enhance clarity [61]. Nevertheless, future studies, where possible, should utilise a longitudinal approach. In addition to improving reliability, this could help establish directions of causality. Moreover, the COVID-19 global pandemic perseveres, with constantly evolving restrictions, lockdowns and measures such as increased home-working: all of which are liable to have long-term impacts on psychological, social and health-related wellbeing. Our study only provides a snapshot of changes during the initial, strict lockdown: longer-term follow up studies could assess how ongoing restrictions are influencing behavioural changes to gaming and gambling behaviour, and any long-term influences on wellbeing.

5. Conclusions

For gambling, our results establish that on aggregate, shifts towards increased gambling and problem gambling during national lockdowns may be somewhat limited. Nonetheless, increased PGSI scores during lockdown were associated with decreased wellbeing: suggesting that for some, the negative experiences of lockdown were exacerbated by maladaptive coping strategies.

With gaming, substantial increases in gaming activity did not translate into increases in the number of individuals reaching 'disordered gamer' status. Nonetheless, IGD scores did increase, having a negative correlation with wellbeing changes during the lockdown. It has been previously recognised (i.e., in pre-lockdown datasets) that increased IGD may negatively influence psychosocial wellbeing, including self-esteem, social support, and life satisfaction [64]. Our findings suggest that the socially isolating effects of lockdown could, for some gamers, exacerbate unhealthy lifestyle patterns [8,23]. However, video gaming is a heterogeneous activity—with many formats, genres and styles—and it can often benefit physical activity, social connectedness, and mental health, including during lockdowns [65].

In both gambling and gaming contexts, specific cohorts may be particularly vulnerable to the effects of lockdown, and could benefit from being targeted with more effective coping strategies. In any future lockdowns and pandemics, policy and mitigation strategies could include engagement with content providers: they are well positioned to act as an outreach platform for interventions such as support and counselling, signposting for self-exclusion schemes, and encouragement of pro-social activities to support physical and psychological wellbeing.

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