# Do increased hours of video-gaming predict differences in depression, anxiety, and cognitive flexibility?

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**THESIS PORTFOLIO: CANDIDATE DECLARATION**

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|---|---|
| **Title of degree programme** | **Professional Doctorate in Clinical Psychology** |
| **Candidate name** | **Rob McGrath** |
| **Registration number** | **09002215** |
| **Initial date of registration** | **September 2021** |

**Declaration and signature of candidate**

I confirm that the thesis submitted is the outcome of work that I have undertaken during my programme of study, and except where explicitly stated, it is all my own work.

I confirm that the decision to submit this thesis is my own.

I confirm that except where explicitly stated, the work has not been submitted for another academic award.

I confirm that the work has been conducted ethically and that I have maintained the anonymity of research participants at all times within the thesis.

Signed:  Date: 28.06.2024

## Acknowledgements

Firstly, I would like to thank my supervisor, Michelle. It has been a rollercoaster, and I recognise I have taken up a lot of your time. Thank you for your continued feedback and incredibly helpful supervisions.

Secondly, I would like to thank my fellow trainee, Rukhsaar. You have been invaluable in helping me with the statistics work. I hope to remain in contact and complete research together in the future.

Finally, I would like thank my partner, Abbie. Without your continued support, I would absolutely not be where I am right now. I cannot articulate how much you have helped me; I am incredibly grateful for all the sacrifices that you have made for me.

# Contents

# Thesis Abstract

Paper one is a literature review that investigates how childhood sexual abuse (CSA) victimisation relates to intimate partner violence (IPV) perpetration in adult males. Fourteen studies were identified as relevant following a systematic literature search. The review found that there is an association between CSA victimisation and IPV perpetration in adult males. Methodological limitations have been highlighted and evaluated in this review. Clinical and research implications are discussed, as well as limitations within the review. The second paper discusses a cross-sectional quantitative study that explored the relationship between increased hours of video-gaming and depression symptoms, anxiety symptoms, and cognitive flexibility. It also explored whether there were any group differences between genre of videogame being played, as well as gender of the gamer, on depression symptoms, anxiety symptoms, and cognitive flexibility. 163 participants were recruited for the study. Three multiple regression analyses were conducted, which were followed up with two sets of three ANOVA tests. The findings suggest that increased frequency of video-gaming did not predict a significant reduction in depression or anxiety symptoms, nor did it predict a significant increase in cognitive flexibility. There were no group differences between genre of game played, or between genders. However, findings did show that when age was included, increased video-gaming did predict a significant reduction in depression and anxiety symptoms, as well as a significant increase in cognitive flexibility. The findings highlight the lack of research into casual video-gaming in adulthood. Further research and clinical implications are discussed. The final report is an executive summary of the study carried out in the thesis. The summary received valuable feedback from three people who play videogames frequently. It was written for video-gamers and those who may be interested in this area of research.

# Paper 1: Literature Review

# Examining the Relationship between Childhood Sexual Abuse Victimisation and Intimate Partner Violence Perpetration in Adult Males: A Systematic Review.

**Word count: 8000 (Excluding title page, references, and appendices)**

This literature review has been edited for publication in the journal of "Journal of Aggression and Violent Behaviour". The referencing style of this paper is in APA 7th Edition, and in line with author guidelines (Appendix 2). Before submitting to the journal, further modifications will be made to meet these guidelines.

# Abstract

*Objectives*: This systematic review identifies, summarises, and critically evaluates quantitative studies examining the relationship between childhood sexual abuse (CSA) victimisation and physical, sexual, and psychological intimate partner violence (IPV) perpetration in adult males.

*Method*: A database search was conducted to identify eligible studies. A synthesis and appraisal of methodological quality of the primary studies was conducted.

*Results*: Fourteen studies were reviewed, comprising of a total of 48,249 men. Despite methodological and statistical heterogeneity, this review indicates an association between CSA victimisation and all three (i.e., physical, sexual and psychological) domains of IPV perpetration in adult males. Overall, study quality was assessed as 'fair'.

*Conclusions*: The relationship between CSA victimisation and IPV in adulthood in males requires further exploration. The research in this area is thus far limited to self-report of IPV in non-offending populations. Future studies would benefit from including objective assessments of IPV and from examining the CSA-IPV relationship in offender samples. Further research examining the pathways from CSA to IPV are needed.


# Introduction

## Childhood sexual abuse

Childhood sexual abuse (CSA) is defined as a child (i.e., below the age of 16) being "forced or tricked into sexual activities" (NSPCC) that they cannot consent to due to their age, and can include either contact (i.e., with physical contact being made) or non-contact (i.e., where no physical contact is made) abuse. CSA is a public health problem with significant consequences (WHO, 2017). Figures by the Office for National Statistics (ONS, 2020) indicate that in England and Wales, around 3.1 million people (7.5% of adults) have experienced CSA, but the exact figure is unknown due to under-reporting. CSA is similarly

an issue worldwide with prevalence rates ranging from 8-31% for girls and 3-17% for boys (Barth et al., 2013).

CSA is associated with poorer physical and psychological health outcomes and associated with a range of other adverse childhood experiences (ACEs) such as physical abuse and neglect (Dong et al., 2003), sleep difficulties (Steine et al., 2012), increased likelihood of suicidality (Draper et al., 2008), oversexualised behaviour as a child (Putnam, 2003), depression in childhood, adolescence, and adulthood (Dube et al., 2005), substance misuse (Dube et al., 2003), and obesity (Noll et al., 2008). Additionally, empirical literature indicates that childhood maltreatment (i.e., any violent act towards a child, including physical, psychological, or sexual abuse, or neglect; Pinheiro, 2006) predicts involvement with general criminality in both adolescence and adulthood (Widom & Maxfield, 2001; Basto-Pereira et al., 2016), as well as anti-social and violent behaviour in adolescence and adulthood (Derzon, 2010). In male CSA victims, research has demonstrated a link between CSA and physical (Mullers & Dowling, 2008), and sexual (Vizard et al., 2007) violence in adulthood. Research estimates that CSA costs the UK at least £10 billion annually (Radakin et al., 2021). However, this is based on contact offences only and as such, the true economic burden is likely to be higher.

### Intimate Partner Violence

Intimate partner violence (IPV; also named ‘domestic violence’ in the empirical literature) is defined as “any behaviour within an intimate relationship that causes physical, psychological, or sexual harm to those in the relationship” (WHO, 2012). IPV is a global public health concern (Devries et al., 2013) due to the resulting negative health and social outcomes (Carmichael, 2008). In the UK, reports suggest that 27.1% of adult (i.e., 18 years old+) women and 13.2% of adult men have experienced IPV (ONS, 2016).

IPV affects victims beyond the immediate physical harm experienced (Giridhar, 2012). It is also associated with psychological harm (Lipsky et al., 2005) and IPV victimisation may have a greater impact than other traumas (e.g., combat trauma) as the victim often trusts the perpetrator (Herman, 1992). Whilst research has typically focused on physical (e.g., kicking, hitting) IPV, it is now recognised (WHO, 2013) that IPV perpetration can take other forms, including sexual (e.g., forcing someone to engage in specific sexual acts), and psychological (e.g., humiliation, intimidation) IPV. Physical IPV victimisation can result in an increased likelihood of further traumatisation (i.e., other types of IPV victimisation; Coker et al., 2000a), and poorer mental health (Briere & Jordan, 2004). Psychological IPV victimisation has been associated with an increased likelihood of depression, poorer self-esteem and socioeconomic status (Al-Modallal, 2012). Sexual IPV is associated with increased fear

(Herman, 1992) and Post-traumatic Stress Disorder (PTSD; Campbell et al., 2009). Additionally, sexual IPV is reported to be the most common type of abuse faced by women worldwide (Vives-Cases et al., 2011).

IPV costs the UK an estimated £66 billion annually (Oliver et al., 2019). It has become an increasing concern in the UK (MacManus et al., 2022), likely due to the increased prevalence during the COVID-19 pandemic (Campbell, 2020). It is therefore important to understand contributing factors. A range of risk factors have been associated with IPV including substance misuse (Bennett, 2008), lower socio-economic status (Kiss et al., 2012), low marital satisfaction (Stith et al., 2004), and gendered beliefs relating to men holding power (Ridgeway & Correll, 2004). Research suggests these risk factors are cumulative and a variety of complex factors (e.g., Personality Disorder diagnosis) can increase the risk of IPV perpetration (Dixon & Graham-Kevan, 2011). Furthermore, studies have reported an association between ACEs and IPV perpetration (Fleming et al., 2015). For example, Ehrensaft and colleagues (2003) reported that experiencing physical and sexual childhood abuse, in addition to childhood conduct problems, predicted IPV perpetration in adult males.

## Association between CSA victimisation and IPV perpetration

Whilst the association between developmental trauma (e.g., neglect, parental substance misuse) and adult offending is well-established (e.g., Fox et al., 2015), the relationship between CSA victimisation and IPV perpetration is less researched. Existing research indicates an association between ACEs and IPV perpetration (Bell & Higgins, 2015), however the specific pathways from CSA victimisation and IPV perpetration remains unclear. Several theoretical models have sought to explain the relationship between experiencing violence in childhood and the perpetration of violence in adulthood. For example, the Intergenerational Transmission of Violence Theory (ITVT; Kalmuss, 1984) hypothesises that children who witness inter-parental violence are more likely to engage in IPV in their adult relationships (Black et al., 2010).

More recently, the General Aggression Model (GAM; Anderson & Bushman, 2002) has been applied to understand IPV. The GAM is an integrative framework for understanding aggression and considers personal (e.g., gender, IQ) and situational (e.g., poverty) factors that can independently impact on an individual's internal states (e.g., cognitions), subsequently influencing behaviour (Bushman & Anderson, 2020). The GAM hypothesises that individuals who experience childhood maltreatment are more likely to develop 'aggressive scripts' (i.e., "conflict should be resolved with aggression"; Allen et al., 2018). As such, men with developmental trauma histories are more likely to use violence to deal with frustration as it is "acceptable" (Wareham et al., 2009). Another model, the Developmental

Traumatology Model (De Beilis & Putnam, 1994) suggests victims of childhood maltreatment are more likely to develop PTSD. Individuals with PTSD symptoms tend to hold beliefs that others are seeking to intentionally hurt them, consequently exhibiting aggression, including IPV perpetration (Taft et al., 2011).

In support of the ITVT model, a recent meta-analysis (Li et al., 2020) reported a small effect size ($r$ = 0.16) for the association between ACEs—including CSA—and IPV perpetration, with a stronger relationship in males than females. Furthermore, there was a significant relationship between CSA and IPV perpetration, but specific data pertaining to males only was not reported.

### The current review

Existing reviews and meta-analyses have focused on childhood maltreatment more generally and IPV perpetration (Li et al., 2020), as well as CSA and general criminality (McGrath et al., 2011). However, this is the first known review to examine studies evaluating the relationship between CSA victimisation specifically and IPV perpetration in adult males (i.e., individuals assigned as male at birth). Given the majority of IPV is perpetrated by male intimate partners (Garcia et al., 2005), it was considered prudent to review studies focusing on men. Furthermore, studies examining the link between CSA and all three domains of IPV perpetration were included, as empirical studies have reported associations between CSA and physical (Godbout et al., 2017), psychological (Rosen et al., 2002), and sexual (Fulu et al., 2013) IPV.

Specific aims of the current review are: 1) to review quantitative studies that have examined the relationship between CSA victimisation and IPV perpetration in adult male samples; 2) to provide a narrative synthesis of these studies; 3) to evaluate the methodological quality of studies included; and 4) to provide recommendations for future research investigating CSA victimisation and IPV perpetration.

## Method

### Search procedure

Searches were conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidance (Moher et al., 2009). Scoping searches were conducted using Google Scholar to identify gaps in the literature. A subsequent database search including PsycInfo, Web of Science, SCOPUS, and

Staffordshire University Online Search Engine was conducted using the following search strings: (“childhood sexual abuse” and “intimate partner violence”) OR (“childhood sexual abuse” and “domestic violence”). Follow up searches were conducted to source studies specific to each IPV domain. The above databases were searched using the following search strings: (“childhood sexual abuse” and “physical intimate partner violence”) OR (childhood sexual abuse” and “physical domestic violence”) OR (“childhood sexual abuse” and “sexual intimate partner violence”) OR (“childhood sexual abuse” and “sexual domestic violence”) OR (“childhood sexual abuse” and “psychological intimate partner violence”) OR (“childhood sexual abuse” and “psychological domestic violence”). Grey literature was searched using OpenGrey, DART, and ETHOS using the same search strings. However, grey literature was not included in this review as it had not undergone a peer-review process. Without such stringent processes as those involved in peer-review, grey literature is at a greater risk of potentially being biased, inaccurate, or incomplete.

In order to ensure eligible studies were not missed, additional searches of reference lists of eligible studies were undertaken, and relevant titles screened. No further studies were identified via this method. No date limiters were used.

## Inclusion and exclusion criteria

Study inclusion criteria were: (1) longitudinal, cohort, cross-sectional, or case-control designs; (2) quantitively assessed the association between CSA victimisation (i.e., any CSA prior to the age of 16) and IPV perpetration (i.e., any type of physical, sexual, or psychological abuse towards an intimate partner) as an adult (i.e., above the age of 18); (3) studies that directly measured CSA victimisation and IPV perpetration either using validated psychometric measures, or studies where participants endorsed CSA and IPV via one- or multiple-item questions (e.g., ‘Were you forced into a sexual act before the age of 16?’); (4) published in a peer-reviewed journal; and (5) studies reporting data pertaining to male participants was analysed and reported separately in those studies that included both males and females.

Exclusion criteria were: (1) no measure of CSA nor IPV; (2) qualitative and single case studies; (3) non-peer reviewed (e.g., book chapters, conference presentations, and dissertations/theses); (4) literature reviews; (5) studies developing a scale or questionnaire measure of CSA and/or IPV; (6) non-English language (due to lack of translation facilities).

## Study selection and data extraction

The study selection process is illustrated in Figure 1. The searches produced 1789 results. Eligibility was established based on screening the article title, abstract, and full text. Duplicate results were removed after titles and abstracts were screened for inclusion by the first author (RMc). Once duplicates and ineligible studies were removed, 43 full-text articles were independently assessed by the first author. Fourteen studies met full eligibility criteria. Data was extracted using an electronic customised data extraction form, based on the relevant demographic (e.g., mean age) characteristics of the sample, study design, measures used to assess variables of interest, and main outcomes. Meta-analysis was not conducted due to the significant methodological and statistical heterogeneity across the studies reviewed. As such, the current review narratively synthesises the studies which met inclusion eligibility.

## Quality assessment

The methodological quality of included studies was appraised using the National Institute of Health (NIH; NIH, 2013) quality assessment toolkit for cross-sectional studies. The toolkit requires assessor(s) to rate various methodological and statistical concepts to ascertain the internal validity of primary studies. 14 items assess a range of components relating to study quality including sample size justification, confounding variables, and the validity / reliability of outcome measures. The NIH toolkits are not designed to offer a global quality rating. Rather, critical appraisal using this tool involves considering each item and the potential risk of bias. To aid interpretation of study quality and commensurate with recent healthcare-related systematic reviews (e.g., Connolly et al., 2017), each study was rated as ‘Poor’, ‘Fair’, or ‘Good’ based upon the items assessed.

Three items (assessors blinded, different exposure levels, and loss to follow-up) were not included due not being applicable for cross-sectional designs. Each item was assessed as ‘present’, ‘not present’, ‘not reported’, or ‘could not be determined’. ’Exposure’ was defined as CSA victimisation and ‘outcome’ was defined as IPV perpetration. See Appendix 1 for the quality appraisal results.

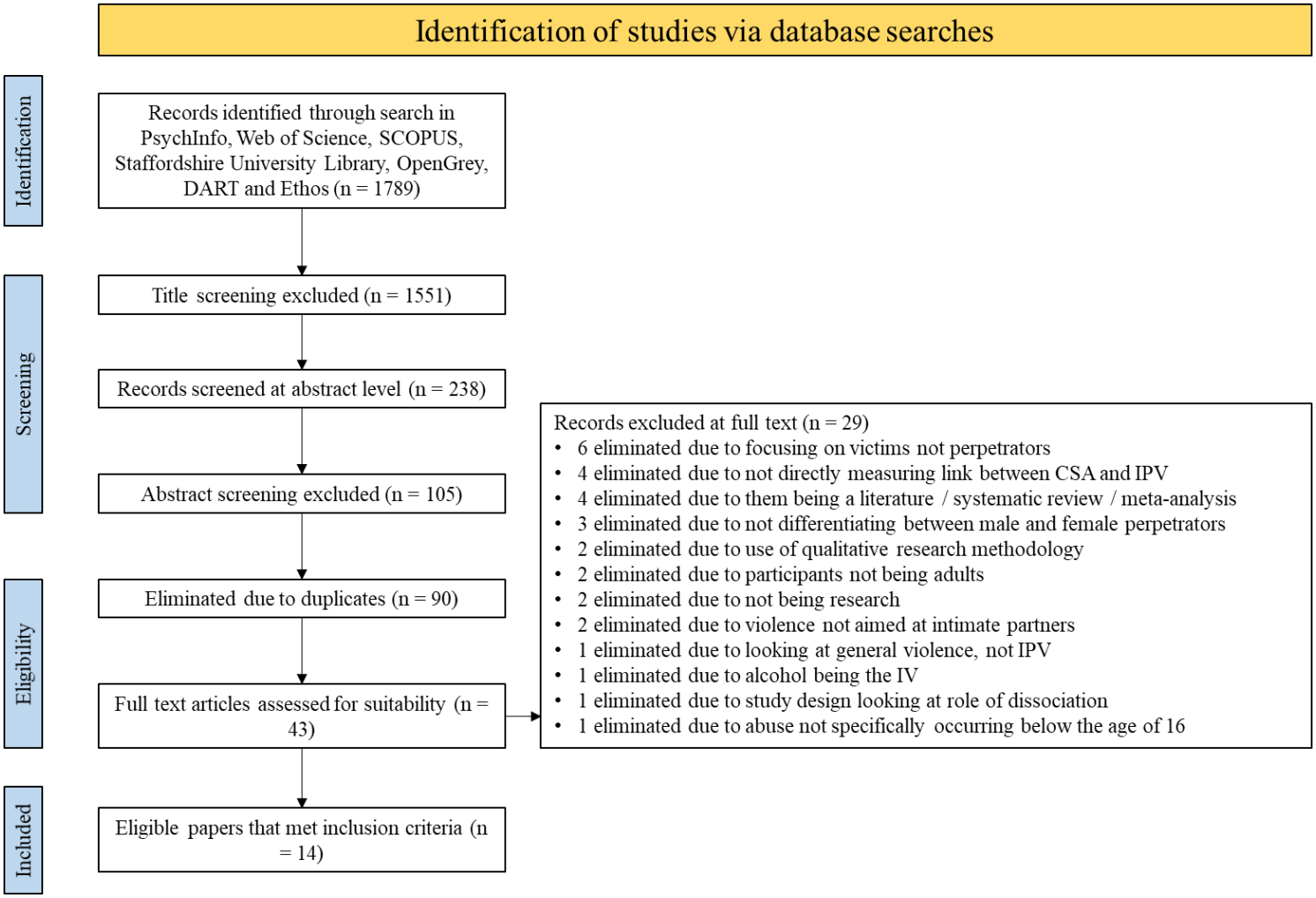


*Figure 1: Prisma flow diagram*

**Table 1**.

*Demographics and Key Findings of the Reviewed Studies*

| Citation and Country of Citation | Study design | Sample | Population | CSA measure(s) | IPV measure(s) | Main outcome(s) |
|---|---|---|---|---|---|---|
| Brassard et al. (2014). Canada | Cross-sectional.<br><br>IPV perpetration assessed in the last 12 months. | *N* = 302, $M^{age}$ = 35 | USA community clinical sample undergoing counselling for relationship difficulties or management of aggression. | One self-report item.<br><br>Endorsement of item was categorised as a positive response for CSA. | *CTS-2 (self-report)*<br>- Psychological IPV perpetration (eight items) in the past 12 months<br>- Physical IPV perpetration (twelve items) in the past 12 months<br><br>7-point Likert scale used to indicate frequency of | History of CSA victimisation significantly correlated with psychological IPV perpetration in the past 12 months.<br><br>History of CSA victimisation non-significantly correlated with physical IPV perpetration in the past 12 months. |

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| | | | | | behaviours (e.g., '3 – 5 times a year). | |
| Brassard et al. (2022). Canada | Cross-sectional.<br><br>IPV perpetration assessed in the last 12 months. | *N* = 198, $M^{age}$ = 34.18<br><br>- Men who had been in a couple relationship in the last 12 months. | USA community clinical sample who had been offered individual therapy for relationship difficulties or management of aggression. | One self-report item.<br><br>Endorsement of item was categorised as a positive response for CSA. | *CTS-2 (self-report)*<br>- Psychological IPV perpetration (eight items) in the past 12 months<br>- Physical IPV perpetration (twelve items) in the past 12 months<br><br>8-point Likert scale used to indicate frequency of behaviours (e.g., '3 – 5 times a year'). | History of CSA victimisation significantly correlated with psychological IPV perpetration in the past 12 months.<br><br>History of CSA victimisation non-significantly correlated with physical IPV perpetration in the past 12 months. |
| Clarke-Walper et al. (2017). USA | Cross-sectional. | *N* = 691, $M^{age}$ = NR | USA armed forces. | *ACE (self-report)*<br>- One item. | *Modified CTS (self-report) assessing the presence of:* | History of CSA victimisation significantly correlated with physical IPV perpetration in the past 12 months. |

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| | IPV perpetration assessed in the 12 months. | - Married men whose most recent deployment was in Iraq. | | 5-point Likert scale used to indicate frequency of abuse (e.g., 'very often'). | - Moderate physical IPV perpetration (four items) in the past 12 months<br>- Severe physical IPV perpetration (four items) in the past 12 months<br><br>Endorsement of *any* items was categorised as a positive response for IPV. | Men with history of CSA had a significantly higher odds ratio of perpetrating physical IPV. |
| Cubellis et al. (2016). USA | Cross-sectional / Retrospective longitudinal.<br><br>IPV perpetration assessed in the last 12 months. | Subset of data from the IDVS. *n* = 13659 (29% male), $M^{age}$ = 23.04<br><br>- Men who had been in a | International sample of University students. | Eight self-report items from IDVS.<br><br>Endorsement of *any* items was categorised as | *CTS-2 (self-report)*<br>- Physical IPV perpetration (12 items) in the past 12 months.<br><br>7-point Likert scale used to indicate frequency of | History of CSA victimisation significantly correlated with physical IPV perpetration in the past 12 months.<br><br>CSA victimisation increased the likelihood of physical IPV perpetration by 50%. |

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| | | relationship for more than 1 month. | | a positive response for CSA. | behaviours (e.g., 3 – 5 times a year'). | |
| Fang & Corso (2007). USA | Cross-sectional / Retrospective longitudinal.<br><br>IPV perpetration assessed in the last 24 months. | Subset of data from Wave 3 of Add Health. *n* = 9368 (45% male), $M^{age}$ = 21.89<br><br>- Men who reported having at least one relationship that included sexual contact in the last 24 months. | USA community sample. | One self-report item from Wave 3 of Add Health.<br><br>Endorsement of item was categorised as a positive response for CSA. | Three self-report items from Wave 3 of Add Health measuring physical and sexual IPV perpetration in the last 24 months.<br><br>Endorsement of *any* items was categorised as a positive response for IPV. | History of CSA victimisation significantly correlated with combined (i.e., where IPV domains were amalgamated into one construct and analysed simply as IPV perpetration) physical and sexual IPV perpetration in the past 24 months. |

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| Fang & Corso (2008). USA | Cross-sectional / Retrospective longitudinal.<br><br>IPV perpetration assessed in the last 24 months. | Subset of data from Wave 3 of the Add Health. *n* = 9352 (45% male), $M^{age}$ = 21.93<br><br>- Sample limited to males who had been in at least one relationship in the last 24 months. | USA community sample. | One self-report item from WAVE 3 of Add Health. | Two self-report items from Wave 3 of Add health measuring physical IPV perpetration in the last 24 months.<br><br>Endorsement of *any* items was categorised as a positive response for IPV. | History of CSA victimisation significantly correlated with physical IPV perpetration in the past 24 months.<br><br>History of CSA victimisation directly and significantly increased the likelihood of physical IPV perpetration by 17.63%. |
| Fulu et al. (2017). International | Cross-sectional. | *N* = 13284 (77% male), $M^{age}$ = NR<br><br>- Representative sample of | Community sample from Asia and the Pacific. | *CTQ (self-report)*<br><br>- Two items. | Fifteen self-report items related to a current or former intimate partner and assessing physical, sexual, and psychological | History of CSA victimisation significantly correlated with physical, sexual, and psychological IPV perpetration in the last 12 months, as well as poly-perpetration (i.e., both physical and sexual IPV [note |

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| | IPV perpetration assessed in the last 12 months. | men aged 18 – 49, randomly selected from census data, in six countries. | Sample was taken across nine diverse (i.e., rural and urban) sites in six countries. | Four-point Likert scale used to indicate frequency of abuse (e.g., 'often'). | IPV perpetration in the last 12 months.<br><br>Measure based on the WHO Multi-country Study on Women's Health and Domestic Violence questionnaire, and a South African survey of IPV adapted for men by the authors.<br><br>Endorsement of *any* items was categorised as a positive response for IPV. | psychological IPV was not included in the reporting of poly-perpetration]). |
| Kamimura et al. (2016). USA | Cross-sectional / Retrospective longitudinal. | Subset of data from the IDVS China Sample. *n* = 731 (38% | Chinese University students. | Self-report items from IDVS | *CTS-2 (self-report)*<br>- 39 items measuring physical, sexual, and psychological IPV | History of CSA victimisation was not significantly correlated with physical IPV across participants' lifetime. |

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| | IPV perpetration assessed across participants' lifetime. | male), $M^{age}$ = 21.60<br><br>- Men who had been in a relationship for a minimum of 1 month. | | (number of items not reported).<br><br>Endorsement of *any* items was categorised as a positive response for CSA. | perpetration across the lifetime. | History of CSA victimisation and statistical relationship to sexual and psychological IPV was not reported. |
| McMahon et al. (2015). USA | Cross-sectional / Retrospective longitudinal.<br><br>IPV perpetration assessed in the last 12 months. | Subset of data from Wave 2 of the NESARC. *n* = 25778 (46% male), $M^{age}$ = NR<br><br>- Men in an intimate relationship in | USA community sample. | *CTQ (self-report)*<br>- Number of items not reported.<br>- 5-point Likert scale used to indicate frequency | *CTS-2 (self-report)*<br>- 6 unreported items measuring physical and sexual IPV perpetration in the last 12 months. | History of CSA victimisation was not significantly correlated with combined physical and sexual IPV perpetration in the last 12 months.<br><br>History of CSA victimisation was significantly correlated with combined reciprocal (i.e., both perpetration *and* victimisation) physical and sexual IPV. |

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| | | the last 12 months. | | of abuse (e.g., 'More than once a month'). | Endorsement of *any* items was categorised as a positive response for IPV. | |
| Norton-Baker et al. (2019). USA | Cross-sectional.<br><br>IPV perpetration assessed across participants' lifetime. | *N* = 873 (28% male), $M^{age}$ = 20.15 | USA University students. | *SAAS (self-report)*<br>- 10 total items.<br><br>Endorsement of *any* items was categorised as a positive response for CSA. | *BPAQ (self-report)*<br>- 9 items measuring lifetime physical aggression.<br><br>*LAVA (self-report)*<br>- Four indices; lifetime aggressive acts, injury to others, trouble from violent acts (e.g., contact with the police) | History of CSA victimisation was significantly correlated with physical IPV perpetration across participants' lifetime. |

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| | | | | | and motivated (e.g., lethal intent) acts. | |
| Renner & Whitney. (2012). USA | Cross-sectional / Retrospective longitudinal.<br><br>No time frame reported for IPV perpetration. | Subset of data from Wave 3 of the Add Health. *n* = 10187 (49% male), $M^{age}$ = 21.80<br><br>- Sample limited to individuals who had been in a romantic relationship in the last six years. | USA community sample. | One self-report item from WAVE 3 of Add Health.<br><br>- Six-point Likert scale used to indicate frequency of abuse e.g., '3 – 5 times'. | Four self-report items from Wave 3 of Add health measuring physical and sexual IPV perpetration.<br><br>Endorsement of *any* items was categorised as a positive response for IPV. | History of CSA victimisation was significantly correlated with combined physical and sexual IPV perpetration.<br><br>History of CSA victimisation also significantly correlated with combined physical and sexual reciprocal IPV perpetration.<br><br>Men with history of CSA had a significantly higher odds ratio of being IPV perpetrators. |
| Richards et al. (2017). USA | Cross-sectional / Retrospective longitudinal. | Subset of data from Wave 4 of the Add Health. *n* | USA community sample. | One self-report items from | *CTS-2 (self-report)*<br><br>- Five self-report items measuring physical | History of CSA victimisation was significantly correlated with physical IPV perpetration in the last 12 months. |

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| | IPV perpetration assessed in the last 12 months. | = 12379 (46% male), $M^{age}$ = 28<br><br>- Heterosexual men only. | | WAVE 4 of Add Health.<br><br>Six-point Likert scale used to indicate frequency of abuse (e.g., '3 – 5 times'). | IPV perpetration in the last 12 months.<br><br>Endorsement of *any* items was categorised as a positive response for IPV. | Men with history of CSA had a significantly higher odds ratio of being IPV perpetrators. |
| Teitelman et al. (2017). USA. | Cross-sectional / Prospective longitudinal.<br><br>IPV in the last 12 months assessed across 3 time points [baseline (operationalised as first affirmative response to any | *N* = 871, $M^{age}$ = NR<br><br>- Men had same partner for 6 months or more at any assessment time. | South African community sample. | 5 self-report items.<br><br>Endorsement of *any* items was categorised as a positive response for CSA. | *CTS-2 (self-report):*<br>- Physical IPV perpetration (2 items) in the past 12 months.<br>- Sexual IPV perpetration (1 item) in the past 12 months. | History of CSA victimisation significantly correlated with combined physical and sexual IPV perpetration in the past 12 months across all three time points.<br><br>Men with history of CSA had a significantly higher odds ratio of perpetrating physical and/or sexual IPV. |

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| | IPV); 6-, and 12-months]. | | | | Endorsement of *any* items was categorised as a positive response for IPV. | |
| Voith et al. (2020). USA | Cross-sectional.<br><br>IPV perpetration assessed in the last 12 months. | *N* = 423, $M^{age}$ = 22.0 | USA University sample. | *CTQ (self-report)*<br>- One subscale consisting of 5 items.<br><br>Five-point Likert scale used to indicate frequency of abuse (e.g., 'Very often true'). | *CTS-2 (self-report)*<br>- 39 items measuring three domains of IPV perpetration (i.e., physical, sexual, and psychological).<br><br>One or more 'yes' response(s) to *any* domain categorised as IPV perpetration.<br><br>8-point Likert scale used to indicate frequency of behaviours (e.g., '3 – 5 times a year'). | History of CSA victimisation significantly and independently correlated with physical, sexual IPV, and poly-IPV perpetration (i.e., both physical and sexual) in the past 12 months.<br><br>History of CSA victimisation not significantly correlated with psychological IPV perpetration. |

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| | | | | Endorsement of *any* items was categorised as a positive response for CSA. | *SES-SFP (self-report)*<br>- 7 items measuring sexual IPV perpetration.<br><br>Endorsement of *any* items was categorised as a positive response for sexual IPV.<br><br>4-point Likert scale used to indicate frequency of behaviours (e.g., 'Once a year'). | |

*CSA = Childhood Sexual Abuse; IPV = Intimate Partner Violence; CTS-2 = Revised Conflict Tactics Scale; CTS = Conflict Tactics Scale; ACE = Adverse Childhood Experiences Study Questionnaire; IDVS = International Dating Violence Study; Add Health = National Longitudinal Study of Adolescent to Adult Health; WHO = World Health Organisation; NESARC = National Epidemiologic Survey on Alcohol and Related Conditions; SAAS = Sexual Abuse and Assault Scale; BPAQ = Buss-Perry Aggression Questionnaire; LAVA = Lifetime Assessment of Violent Acts; CTQ = Childhood Trauma Questionnaire; SES-SFP = Sexual Experiences Short-Form Perpetration Survey; NR = Not Reported; N/A = Not Applicable.*

# Results

## Summary of studies

Overall, fourteen eligible studies were identified. Table 1 provides an overview of the key characteristics and findings. Most studies were undertaken in the USA (*n* = 11). Sample sizes for male participants ranged from 198 to 11,850. All studies employed a cross-sectional design. Longitudinal data was utilised in eight studies; seven were retrospective and one (Teitelman et al., 2017) was prospective. All studies relied on self-report of CSA victimisation and IPV perpetration. Two studies (Brassard et al., 2014; Brassard et al., 2022) used clinical samples, who were responding to court orders, but it was unclear if this indicated any formal conviction. One study (Clarke-Walper et al., 2017) recruited a sample from the US armed forces. Four studies (Cubellis et al., 2016; Kamimura et al., 2016; Norton-Baker et al., 2019; Voith et al., 2020) recruited college / university cohorts; two were US samples, one was a Chinese sample, and one was an international sample. Seven studies (Fang & Corso, 2007; Fang & Corso, 2008; Fulu et al., 2017; McMahon et al., 2015; Renner & Whitney, 2012; Richards et al., 2017; Teitelman et al., 2017) recruited community samples; five were US based, one was based in South Africa, and one was an international sample.

Seven studies analysed data collected from previous larger-scale studies. Four (Fang & Corso, 2007; Fang & Corso, 2008; Renner & Whitney, 2012; Richards et al., 2017) used data from the National Longitudinal Study of Adolescent to Adult Health (Add Health). This was a US national study examining health-related behaviours and outcomes of adolescents, with follow-ups in adulthood, with data collected across four waves: 1994 (Wave 1), 1996 (Wave 2), 2001-2002 (Wave 3), and 2008 (Wave 4). Three studies (Fang & Corso, 2007; Fang & Corso, 2008; Renner & Whitney, 2012) used data from Wave 3 and one (Richards et al., 2017) used data from Wave 4. As such, the same participants were considered more than once within this review. Two studies (Cubellis, 2016; Kamimura, 2016) used data from the International Dating Violence Study (IDVS), although one (Kamimura, 2016) only used data from the Chinese data set. One study (McMahon et al., 2015) used data from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC).

No studies recruited men from prisons, nor men with any known current or historical criminal conviction for IPV.

## Study quality

Quality appraisal results are reported in Appendix 1. All studies reported a clear study question, details about the target population, inclusion / exclusion criteria, and retained 50%+ of participants in the analysis. All studies documented outcome and exposure measures details, however due to lack of reliability and / or validity statistics or specifics details not being reported, only five studies received a positive rating on the exposure measure item. Ten studies received a positive rating on the outcome measure item. Only two studies reported a power analysis. Five studies adequately controlled for confounding variables. Exposure prior to assessment was absent in all studies as exposures and outcomes were measured during the same timeframe. Repeated exposure, and sufficient time frame were also absent in all studies. As three items were omitted, each study was rated out of eleven and categorised accordingly: 0 – 3 'Poor'; 4 – 7 'Fair'; 8 – 11 'Good'. All fourteen studies were rated as 'Fair'.

## Confounding variables and covariates

Of the fourteen studies, seven adequately controlled for confounding variables and/or covariates when examining the relationship between CSA victimisation and IPV perpetration. Clarke-Walper et al. (2017) controlled for education, military rank, alcohol misuse, depression, anxiety, and PTSD. Cubellis et al. (2016) controlled for gender, age, socio-economic status, length of relationship, social desirability, cohabitation status, relationship commitment, and prior physical victimisation. Fang & Corso (2007) controlled for age, gender, race/ethnicity, marital status, school enrolment, and employment status. Fulu et al. (2017) controlled for age, marital status, education level, and socio-economic status. McMahon et al. (2015) and Richards et al. (2017) both controlled for age, income, education, and race/ethnicity, with Richards et al. (2017) also controlling for employment. Brassard et al. (2014) and Brassard et al. (2022) controlled for social desirability, with Brassard (2022) also controlling for family violence history. Voith et al. (2020) controlled for age and sexual orientation.

## Overview of assessment measures

### *Childhood sexual abuse*

Three studies used versions of (McMahon et al., 2015; Voith et al., 2020), or items from (Fulu et al., 2017) the Childhood Trauma Questionnaire (CTQ; Bernstien & Fink, 1998). The CTQ is a well-validated and reliable measure of CSA victimisation (Bernstein et al., 1994). Cronbach's alpha levels vary depending upon the number of items used. For example, Fulu et al. (2017) used two items, reporting an alpha coefficient of 0.69. Voith et al. (2020) used

five items from one subscale, reporting an alpha coefficient of 0.93. McMahon et al. (2015) did not report the number of items used, however reported a reliability coefficient of between 0.79 - 0.88. One study (Norton-Baker et al., 2019) used the dimensional and categorical indices of the Sexual Abuse and Assault Self-Report scale (Barnett et al., 1993), which was developed by the Longitudinal Studies on Child Abuse and Neglect (LONGSCAN) project, but no psychometric statistics were reported. One study (Clarke-Walper et al., 2017) used a modified version of the Adverse Childhood Experiences questionnaire (Felitti et al., 1998). Although a valid and reliable measure of early adverse experiences (e.g., Meinck et al., 2017; Wingenfeld et al., 2011), no psychometric statistics were reported.

Four studies used a one-item question from the Add Health study. Three studies used a question from Wave 3 (Fang & Corso, 2007; Fang & Corso, 2008; Renner & Whitney, 2012), and one from Wave 4 (Richards et al., 2017). These measures were pilot tested (see Udry, 2001) but psychometric statistics were not reported. One study used eight items (Cubellis et al., 2016), from the IDVS study. Kamimura et al., (2016) used an unspecified amount of items from the IDVS study. However, they reported an acceptable reliability coefficient of 0.82.

The remaining three studies used specifically developed items to assess for historical CSA and endorsement of any item was reported as a positive indicator of CSA. For example, one study (Teitelman et al., 2017) used five items and two studies (Brassard et al., 2014; Brassard et al., 2022) used one item. None of these studies reported psychometric statistics.

### *Intimate partner violence perpetration*

Eight studies used versions of (Kamimura et al., 2016; Voith et al., 2020), or items from (Brassard et al., 2014; Brassard et al., 2022; Cubellis et al., 2016; McMahon et al., 2015; Richards et al., 2017; Teitelman et al., 2017) the Revised Conflicts Tactics Scale (CTS-2; Straus et al., 1996), with one study (Clarke-Walper et al., 2017) using items from the Conflicts Tactics Scale (CTS; Straus; 1979), and one study (Voith et al., 2020) also including the Sexual Experiences Survey – Short Form Perpetration (SES-SFP; Koss & Oros, 1982). The CTS-2 has good internal consistency and validity (Chapman & Gillespie, 2019). The CTS is an older version of the CTS-2, but was used as previous studies (e.g., Fonseca et al., 2006) have similarly used it with military populations. It has moderate reliability and validity (Straus, 1987). The SES-SFP is a valid and reliable measure of the perpetration of unwanted sexual experiences (Johnson et al., 2017). One study (Norton-Baker et al., 2019) used the Buss-Perry Aggression Questionnaire (BPAQ; Buss & Perry, 1992) and the Lifetime Assessment of Violent Acts (LAVA; King et al., 2017). Whilst the BPAQ has good validity and internal consistency (Redondo et al., 2017), it is a measure of aggression as

opposed to IPV specifically. However, the LAVA was also used, which does include items assessing IPV specifically, and has good reliability and validity (King & Russell, 2019).

Three studies (Fang & Corso, 2007; Fang & Corso, 2008; Renner & Whitney, 2012) used items from Wave 3 of the Add Health study to measure IPV perpetration, with one (Fang & Corso, 2008) using two items, one (Fang & Corso, 2007) using three items, and one (Renner & Whitney, 2012) using four items. These were pilot tested (see Udry, 2001), but no psychometric statistics were reported. The remaining study (Fulu et al., 2017) used fifteen questions based on the WHOs multi-country study on women's health and domestic violence (Garcia-Moreno et al., 2005) questionnaire, as well as a previously developed culturally specific questionnaire (Fulu et al., 2013) but no details of this were reported. The WHO questionnaire has good reliability and validity (see Garcia-Moreno et al., 2005) but no psychometric data was reported by Fulu and colleagues (2017).

## Relationship between CSA victimisation and IPV perpetration

Overall, twelve of the fourteen studies reported a significant correlation between CSA victimisation and IPV perpetration in adulthood. However, as none of the studies reported effect sizes, it was not possible to ascertain the strength of this relationship. As all studies were cross-sectional, causal inferences cannot be made. Conversely, two studies (Kamimura et al., 2016; McMahon et al., 2015) did not report any significant relationship. All twelve studies that reported a significant correlation were rated 'fair'. Both studies reporting no association were also rated as 'fair', making it difficult to draw firm conclusions.

Results relating to history of CSA victimisation and specific IPV domains (i.e., physical, sexual, and psychological) are reported below. Studies that combined IPV domains are reported separately.

### *CSA and physical IPV perpetration*

Physical IPV perpetration was measured in all fourteen studies reviewed, with ten reporting the results independent of other domains. Six studies used the CTS-2, and three of these (Cubellis et al., 2016; Richards et al., 2017; Voith et al., 2020) reported that CSA victimisation was significantly related to physical IPV perpetration. One study (Cubellis et al., 2016) used the full data set from the IDVS, reporting that CSA victimisation increased the likelihood of IPV perpetration by 50%. A second study (Kamimura et al., 2016) also used data from the IDVS, using the CTS-2, but reported results for the Chinese data set only. No significant correlation was reported. However, it is possible that this reflects cultural norms relating to IPV (e.g., greater gender inequality) in Chinese cultures (Xu et al., 2005). Of the

studies that used the CTS-2, both Richards et al. (2017) and Fang & Corso (2008) reported that CSA victimisation was significantly related to physical IPV perpetration. Additionally, Richards et al. (2017) reported that males who reported a history of CSA had a significantly higher odds ratio of perpetrating IPV compared with females. Furthermore, Fang & Corso (2008) found CSA victimisation increased the likelihood of physical IPV perpetration by 17%.

One study (Clarke-Walper et al., 2017) used the CTS, reporting that CSA victimisation was significantly related to physical IPV perpetration, and that CSA victimisation led to a significantly higher odds ratio of perpetrating physical IPV. Two studies (Fulu et al., 2017; Norton-Baker et al., 2019) both found a significant relationship between CSA victimisation and physical IPV perpetration. Norton-Baker and colleagues (2019) reported the relationship between CSA and physical IPV perpetration remained significant even when controlling for other childhood abuse types (e.g., physical abuse). Fulu and colleagues (2017) found a consistent and significant relationship across different countries in Asia and the Pacific.

Two studies (Brassard et al., 2014; Brassard et al., 2022), both using the CTS-2, did not find a significant correlation between CSA and physical IPV. However, both studies had the smallest sample sizes of the studies reviewed and neither reported a power analysis to ascertain sample size. As such, both studies may have been underpowered to detect all but the largest effects.

### *CSA and sexual IPV perpetration*

Whilst sexual IPV perpetration was measured in seven of the fourteen studies reviewed, only two reported the results independent from other domains. One study (Voith et al., 2020) used the CTS-2 to measure sexual IPV perpetration, finding a significant correlation with CSA victimisation. In addition, this study also reported a significant correlation with CSA victimisation and poly-perpetration (i.e., both physical *and* sexual IPV perpetration). Similarly, Fulu et al. (2017) found a significant correlation between CSA victimisation and sexual IPV perpetration when using questions based on the WHO's multi-country study on women's health and domestic violence questionnaire, which for sexual IPV focused on forced and coerced sex and sex acts. Furthermore, and commensurate with Voith and colleagues (2020), Fulu and colleagues (2017) also reported a significant correlation between CSA victimisation and poly-perpetration.

### *CSA and psychological IPV perpetration*

Psychological IPV perpetration was measured in four of the fourteen studies reviewed, with three reporting the results independent from other domains. All three (Brassard et al.,

2014; Brassard et al., 2022; Voith et al., 2020) used the CTS-2 to measure psychological IPV perpetration. Two studies (Brassard et al., 2014; Brassard et al., 2022) found a significant association between CSA victimisation and psychological IPV perpetration. Both studies had relatively small samples sizes, and recruited clinical samples of men undergoing counselling for relationship difficulties or management of aggression. Conversely, Voith and colleagues (2020) found no significant association between CSA victimisation and psychological IPV perpetration, despite finding a significant association between other childhood maltreatment types (i.e., childhood physical abuse) and psychological IPV perpetration.

### *CSA and combined IPV perpetration*

A number of the studies assessed different IPV domains independently, but when reporting results, combined them into a single construct (i.e., IPV). Of the fourteen studies, four (Fang & Corso, 2007; McMahon et al., 2015; Renner & Whitney, 2012; Teitelman et al., 2017) analysed results as a single IPV construct, all combining physical and sexual IPV domains. Results were mixed. For example, Teitelman et al. (2017) found a significant correlation between CSA victimisation and combined IPV perpetration at three time points (i.e., baseline, six, and twelve months), in addition to reporting that CSA victimisation significantly increased the odds ratio of perpetrating combined IPV. Conversely, McMahon et al. (2015) did not report a significant correlation, despite finding a significant correlation between general childhood maltreatment (i.e., when physical, sexual and emotional abuse, and emotional and physical neglect were combined into one variable) and IPV perpetration. However, they did find a significant relationship between CSA victimisation and combined reciprocal (i.e., both perpetration *and* victimisation) IPV, suggesting men reporting a history of CSA were significantly more likely to experience both IPV victimisation and perpetration, but not IPV perpetration alone.

Two studies (Fang & Corso, 2007; Renner & Whitney, 2012) used data from Wave 3 of Add Health, both reporting a significant correlation between CSA victimisation and combined IPV perpetration. Renner & Whitney (2012) also reported that men endorsing CSA victimisation had a significantly higher odds ratio of being IPV perpetrators, as well as exploring the link between CSA victimisation and reciprocal[1] IPV. Although CSA victimisation was significantly correlated with combined IPV perpetration, there was a stronger correlation between CSA and reciprocal IPV, consistent with McMahon and colleagues (2015) findings.

[1] Referred to as “bi-directional” IPV in this study.

# Discussion

## Summary of findings

The aims of review were to systematically review quantitative literature investigating the relationship between CSA victimisation and IPV perpetration in adult males, and to critically appraise the quality of this literature. Overall, results indicate a consistent relationship between CSA victimisation and IPV perpetration in adulthood, with twelve of the fourteen studies reporting a statistically significant relationship. However, the strength of this relationship remains unclear. Two studies (McMahon et al., 2015; Renner & Whitney, 2012) also explored the link between CSA victimisation and reciprocal IPV, both finding a significant link, indicating that victims of CSA, in addition to being more likely to commit IPV perpetration, are also more likely to be a victim of IPV. Quality appraisal indicated that all studies were rated as 'fair'.

## Future research

Future research would be strengthened by recruiting offender samples (i.e., men convicted of IPV offences) in order to remove the reliance on self-report and reduce the potential for social desirability to impact on reliable reporting. Whilst the majority of studies used the CTS-2 to measure IPV, which is a valid and reliable measure (Chapman & Gillespie, 2019), some studies used measures of general aggression (e.g., BPAQ; Norton-Baker et al., 2019) or items with no psychometric statistics reported (e.g., Fang & Corso, 2007), which may not adequately capture specific IPV behaviour(s). As such, future research would be strengthened by utilising measures that have been specifically developed for, and validated in, IPV populations.

Only a small number of reviewed studies controlled for potential confounding variables (e.g., age, mental health difficulties) making it difficult to draw firm conclusions regarding the relationship between CSA victimisation and IPV perpetration. Studies also controlled for various combinations of variables suggesting results be interpreted cautiously. Future studies would benefit from controlling for potential confounding variables that have been demonstrated to impact on the risk of IPV (e.g., substance use; Stuart et al., 2009).

Whilst this review aimed to examine the evidence for a relationship between CSA victimisation and specific IPV domains, several studies combined domains and reported results as a single construct. Physical, sexual, and psychological violence have different prevalence rates (Coker et al., 2000b), as well as impacting victims differently (Jordan et al., 2010). Moreover, this review has indicated that CSA may be differentially related to specific

domains of IPV (e.g., Brassard et al., 2014). As such, future research should attempt to disentangle these relationships. Currently, whether CSA is associated with specific domains of IPV is unclear and results require replication before they can be interpreted with more certainty.

Finally, ten of the fourteen studies used data from Western cultures. As such, results may not be generalisable to men from different cultures. Indeed, Kamimura and colleagues (2016) did not report a significant association between CSA victimisation and physical IPV in a Chinese subsample of men, suggesting there may be additional cultural factors impacting the relationship between CSA and IPV. Future studies would benefit from recruiting men from diverse backgrounds to further explore the impact of culture.

## Limitations

### *Limitations of primary papers*

There are several limitations of the reviewed studies. None recruited offender populations of men with convictions for IPV offences. Consequently, results may not be generalisable to men convicted of IPV offences. As it is possible that offender samples may engage in more serious IPV acts compared with non-offender samples, future research should control for IPV severity. Also, all studies relied on self-report to assess IPV perpetration. Self-report is typically inconsistent (Devaux & Sassi, 2016) and weakly associated with actual behaviour (Dang et al., 2020). Additional factors which may bias self-reporting, such as shame, were also not controlled for. Given shame is higher in IPV perpetrators (Rand, 2004; Harper et al., 2005) compared to non-perpetrators, as well as in males with a history of CSA (Dorahy & Clearwater, 2012), future research would benefit from exploring shame when examining this relationship.

The studies in this review used various measures to assess CSA victimisation and IPV perpetration. In addition, some of the studies that used modified versions of existing measures did not report which items were included. Similarly, psychometric data were often not reported. Several studies also used single-item measures to assess for CSA, which may not have fully captured the construct of interest. As such, future studies would benefit from using psychometrically validated measures to assess both CSA and IPV. In particular, measures specifically developed and validated for IPV populations would strengthen conclusions.

Finally, all studies were cross-sectional. Whilst some studies analysed retrospective data, and one study analysed prospective data (Teitelman et al., 2017), none of the studies used a longitudinal design. As such, it is not possible to draw causal inferences relating to the relationship between CSA victimisation and IPV perpetration in adulthood.

### *Review limitations*

Due to the methodological and statistical heterogeneity of the reviewed studies, a quantitative synthesis of findings was not possible. A quantitative synthesis would support ascertaining the strength or magnitude of the relationship between CSA and IPV perpetration. Another limitation is the exclusion of grey literature. Whilst grey literature was searched, by excluding studies not published in peer-reviewed journals, it is possible that studies with null findings were excluded or eligible studies overlooked. Furthermore, whilst the search strategy and terms used were comprehensive, it is possible that relevant but older studies were missed due to changes in IPV terminology (e.g., older studies may have used the term ‘batterer’).

## Clinical and research implications

Further exploration of the specific pathways from CSA to IPV perpetration is a key area for future research. The current review indicates a significant relationship between CSA victimisation and IPV in adult males. Future research elucidating specific mediators and moderators of this relationship may inform the development of targeted interventions. For example, although not reported in this review, one paper (Brassard et al., 2014) conducted a path analysis, finding CSA victimisation predicted IPV perpetration through processes such as attachment anxiety. Research focused on understanding any specific processes (e.g., Godbout et al., 2009) underpinning specific IPV domains is important for future interventions targeted at addressing specific risk factors.

Additionally, it may be pertinent to invest resources in preventative interventions by offering specialised support for young males who have experienced CSA. For example, insecure attachment styles are common in people who have experienced CSA (Ensink et al., 2020), and therefore, evidence-based interventions underpinned by attachment theory, such as Emotionally Focused Therapy, (Johnson, 2002; MacIntosh & Johnson, 2008) might be beneficial. Additionally, including people who have experienced CSA in the development of interventions may aid the development of proactive support, such as the development of internal strategies of managing conflict.

# Conclusion

This systematic review synthesised the quantitative research examining the relationship between CSA victimisation and IPV perpetration in adult males. A quality appraisal indicated that all studies were of 'fair quality'. Overall, findings suggest an association between CSA victimisation and IPV perpetration in adult males. A number of recommendations have been made regarding future research as well as discussing the clinical implications of these results.

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# Appendices

## Appendix 1 – NIH Quality Appraisal Tool

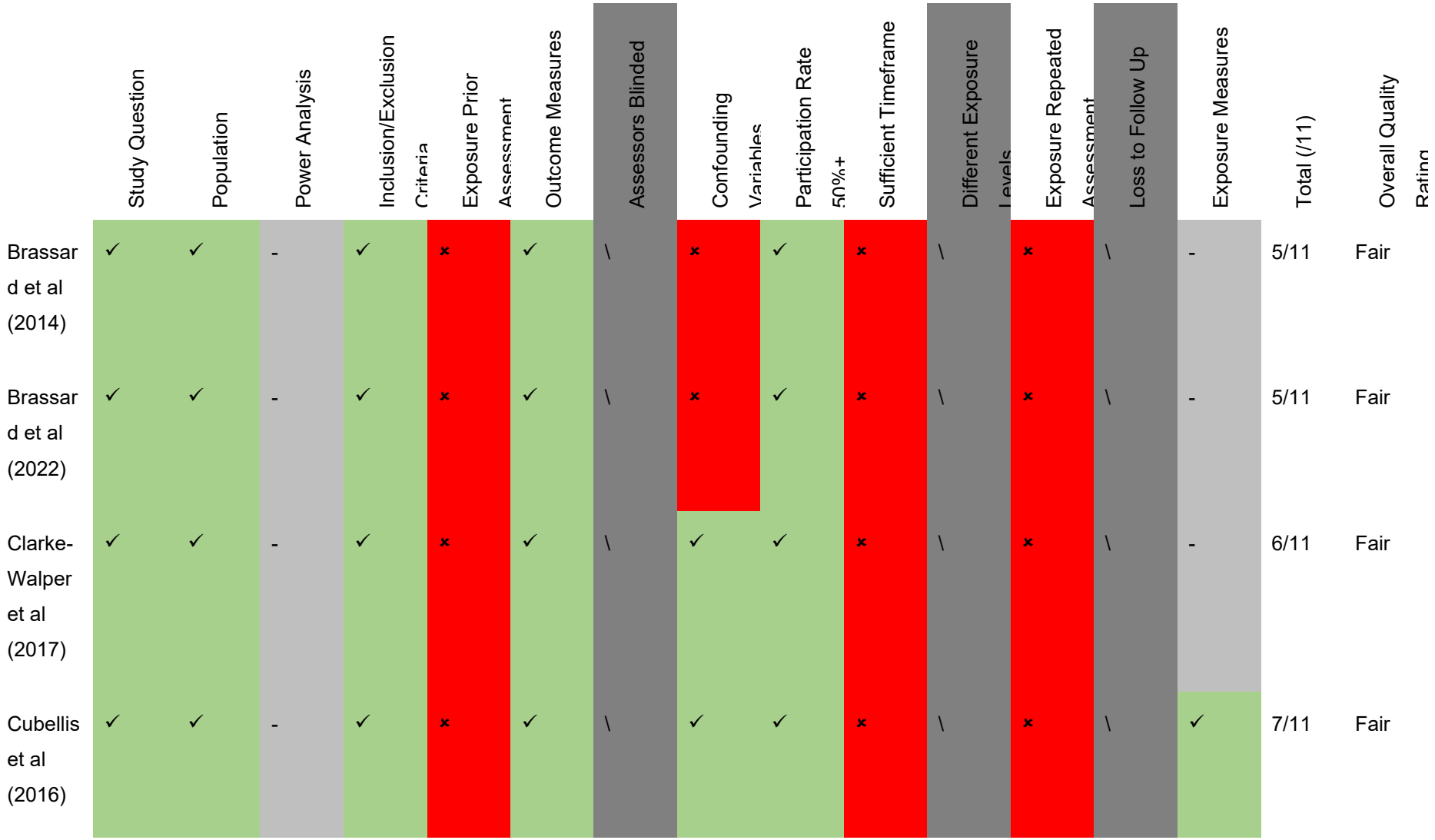
| | |
|---|---|
| Yes | ✓ |
| No | × |
| NR | - |
| CD | ? |
| NA | \ |

CD – Cannot determine

NR – Not reported

NA – Not applicable

(exposure = CSA, outcome = IPV)


Study Question
Population
Power Analysis
Inclusion/Exclusion Criteria
Exposure Prior Assessment
Outcome Measures
Assessors Blinded
Confounding Variables
Participation Rate 50%+
Sufficient Timeframe
Different Exposure Levels
Exposure Repeated Assessment
Loss to Follow Up
Exposure Measures
Total (/11)
Overall Quality Rating
Brassard et al (2014) ✓ ✓ - ✓ × ✓ \ × ✓ × \ × \ - 5/11 Fair
Brassard et al (2022) ✓ ✓ - ✓ × ✓ \ × ✓ × \ × \ - 5/11 Fair
Clarke-Walper et al (2017) ✓ ✓ - ✓ × ✓ \ ✓ ✓ × \ × \ - 6/11 Fair
Cubellis et al (2016) ✓ ✓ - ✓ × ✓ \ ✓ ✓ × \ × \ ✓ 7/11 Fair

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fang & Corso (2007) | ✓ | ✓ | - | ✓ | × | - | \ | ✓ | ✓ | × | \ | × | \ | - | 5/11 | Fair |
| Fang & Corso (2008) | ✓ | ✓ | - | ✓ | × | - | \ | × | ✓ | × | \ | × | \ | - | 4/11 | Fair |
| Fulu et al (2017) | ✓ | ✓ | ✓ | ✓ | × | ? | \ | ✓ | ✓ | × | \ | × | \ | ✓ | 7/11 | Fair |
| Kamimura et al (2016) | ✓ | ✓ | - | ✓ | × | ✓ | \ | × | ✓ | × | \ | × | \ | ✓ | 6/11 | Fair |
| McMahon et al (2015) | ✓ | ✓ | - | ✓ | × | ✓ | \ | ✓ | ✓ | × | \ | × | \ | ✓ | 7/11 | Fair |
| Norton-Baker et al (2019) | ✓ | ✓ | - | ✓ | × | ✓ | \ | × | ✓ | × | \ | × | \ | - | 5/11 | Fair |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Renner & Whitney (2012) | ✓ | ✓ | - | ✓ | × | - | \ | × | ✓ | × | \ | × | \ | - | 4/11 | Fair |
| Richards et al (2017) | ✓ | ✓ | - | ✓ | × | ✓ | \ | ✓ | ✓ | × | \ | × | \ | - | 6/11 | Fair |
| Teitelman et al (2017) | ✓ | ✓ | - | ✓ | × | ✓ | \ | × | ✓ | × | \ | × | \ | - | 5/11 | Fair |
| Voith et al (2020) | ✓ | ✓ | ✓ | ✓ | × | ✓ | \ | × | ✓ | × | \ | × | \ | ✓ | 7/11 | Fair |

Cross Sectional Studies: Poor (0 – 3); Fair (4 – 7); Good (8 – 11)

## Appendix 2 – Author guidelines

Please refer to the Journal of Aggression and Violent Behaviour webpage for the full author guidelines: https://www.sciencedirect.com/journal/aggression-and-violent-behavior/publish/guide-for-authors

- APA 7th referencing has been used in the current paper as per journal guidelines.
- The abstract is structured (Objectives, Methods, Results, and Conclusions).
- All tables follow APA 7th style
- General structure has been followed throughout.
- All other formatting will be conducted prior to submission to the journal.

# Paper 2: Empirical paper

# Do increased hours of video-gaming predict differences in depression, anxiety, and cognitive flexibility?

**Word count:** 7954 (Excluding the title page, references, and appendices)

This report is intended for publication in the journal “Computers in Human Behavior”. The referencing style of this paper is in APA 7th Edition, and in line with author guidelines (Appendix 18). Before submission to the journal, further modifications will be made.

# Abstract

Playing videogames is a common hobby. Although research exists examining the role of 'problematic gaming' (i.e., gaming addiction), non-problematic video-gaming is under-researched. Additionally, most studies focusing on video-gaming utilise child and adolescent samples, with few studies focusing on adults. This study investigates whether increased (i.e., more frequent) non-problematic video-gaming (i.e., those who play video-games who do not meet the threshold for addiction) predicts lower depression and anxiety symptoms, and improved cognitive flexibility. This study also investigates whether there are any group differences between gender and genre of videogame (e.g., first person shooter, role-playing games etc.) played and the outcome variables of anxiety, depression, and cognitive flexibility. 163 participants who self-identified as non-problematic video-gamers were recruited via an online study. Multiple regression analyses indicated that increased frequency of video-gaming did not significantly predict a decrease in depression nor anxiety symptoms, neither did it significantly predict an increase in cognitive flexibility. Additionally, there was no differences in depression or anxiety symptoms, or cognitive flexibility, between genre of videogames played or between genders. Results are discussed in reference to future research focusing on the impact of videogames specifically on adults, as the literature is limited.

# Introduction

## Mental Health Difficulties

Current statistics report that around 1 in 6 individuals in the UK reports experiencing a "common" mental health problem (e.g., depression, anxiety) in any given week (Baker & Kirk-Wade, 2023). These are characterised by changes in behaviour, reduced emotional control, and functional impairment (NICE, 2022). During the recent COVID-19 pandemic, research showed that 'lockdowns' negatively impacted on adults in the UK, with a rise in depression and anxiety symptoms (O'Connor et al., 2021). It is therefore important that individuals who are experiencing mental distress have a range of coping mechanisms that may aid in improving their mental state, including hobbies (Fancourt et al., 2023).

## Video-gaming

Playing video games is a common hobby, with unofficial figures indicating that in 2022, the number of adults playing video games exceeded 1.7 billion (Jovanovic, 2022). The number of people who play videogames as a hobby is increasing (Clement, 2021) due to videogames and videogame technology becoming more complex, realistic, and attractive (Li et al., 2023). During the COVID-19 pandemic there was an increase in screen time (Pandya & Lodha, 2021; Sultana et al., 2021), as well as an increase in videogame usage (Newzoo, 2020; Barr & Copeland-Stewart, 2021). Research has found that increased screen time is related to poorer mental health (Babic et al., 2017), however direct correlation between increased videogame usage specifically and poorer mental health is less clear. Much of the existing research on mental health and video-gaming focuses on 'problematic gaming' (e.g., Mentzoni et al., 2011; Mannikko et al., 2020), including links to depression and anxiety diagnoses (Wei et al., 2012). Consequently, the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) now includes a diagnosis of 'Internet Gaming Disorder' characterised by "significant impairment or distress" in several aspects of functioning (APA, 2013). Similarly, the International Classification of Diseases (ICD-11) includes a diagnosis of 'Gaming Disorder', defined as "a pattern of gaming behaviour characterised by impaired control over gaming, increasing priority given to gaming over other activities to the extent that gaming takes precedence over other interests and daily activities, and continuation or escalation of gaming despite the occurrence of negative consequences" (WHO, 2022). Neither the DSM-V nor ICD-11 indicate a minimum period of time that indicates problematic gaming, but instead it is categorised as causing "clinically significant impairment" (Petry & O'Brien, 2013) in relation to daily functioning.

The impact of video-gaming not categorised as 'problematic' is under-researched, with most of that research also focusing on adolescents (e.g., Tortolero et al., 2014; Janssen,

2016). However, demographics show that videogames are increasingly being played by adults. In the USA in 2022, approximately 75% of videogame players were over the age of 18 (ESA, 2022). There has also been a demographic shift in terms of videogame players. Video-gaming has long been seen as a male dominated hobby (Leonhardt & Overa, 2021). However, current literature indicates that the number of female video-gamers is increasing (Lopez-Fernandez et al., 2019), although this remains an under-researched area (McLean & Griffiths, 2018). Gender differences have been reported across several domains relating to video-gaming such as motivation to play, social interaction within multiplayer videogames, and skills and performance (for a review of the literature, see Vetri et al., 2014). Additionally, in adolescent samples, between group differences indicate that the association between increased screen time and mental health difficulties in female gamers is stronger compared with males (Twenge & Farley, 2021).

The impact of genre of videogame-play on mental health is also under-researched, with much of the research again focusing on 'problematic gaming' as well as on children and adolescents (Petry, 2011). For example, the Massive Multiplayer Online Role-Playing Games (MMORPG) genre—a genre where players play a story-driven online game and interact with a large number of other players—has been described as "exploitative" (Hill, 2007) and can predispose players to 'problematic gaming' (Elliot et al., 2012). Elliot et al. (2012) also found that adults with 'problematic gaming' were more likely to play first-person shooter, action, and role-playing games. However, there is some emerging evidence that genre of games played in non-problematic gamers can improve player's creativity (Moffat et al., 2017), as well as evidence that action games are associated with fewer depression symptoms (Cancer et al., 2020).

Finally, research specifically on the impact of increased video-gaming in terms of hours of play, and not just video-gaming versus non-video-gaming, on depression and anxiety symptoms is limited. Increased screen time, including video-gaming, has been shown to correlate with greater levels of depression and anxiety symptoms (e.g., Cao et al., 2011; Maras et al., 2015) in adolescents. Other studies have shown that "moderate video-gaming" (i.e., not complete abstinence, nor excessive levels; Hartanto et al., 2021) can improve an individual's mood (Jones et al., 2014). To explain this, researchers (Przybylski & Weinstein, 2017) have proposed a "digital Goldilocks" zone, whereby a moderate amount of video-gaming was associated with the most beneficial outcomes for well-being.

## Cognitive Flexibility

Cognitive flexibility definitions vary, from "the ability to generate broad or narrow categorisations of stimuli depending on appropriateness" (Murray et al., 1990) to "the ability

to match the type of cognitive processing with the type of problem at hand" (Laureiro-Martinez & Brusoni, 2018). Essentially, cognitive flexibility enables individuals to think adaptively during stressful events and is an important skill that helps individuals from becoming stuck in unhelpful thinking patterns (Dennis & Vander Wal, 2010). Cognitive flexibility is associated with planning, goal development, and achieving tasks (Best et al., 2009). Impairments in cognitive flexibility have been linked with mental health conditions such as anxiety (Park & Moghaddam, 2017).

As many videogames require players to engage in problem-solving (e.g., Adachi & Willoughby, 2013)—one of the core constructs underlying cognitive flexibility—it is possible that playing videogames may impact cognitive flexibility. For example, improved problem-solving abilities have been found in people who play videogames (Liu et al, 2011). A recent review (Reynaldo et al., 2021) found that students who played videogames showed improved performance on cognitive tasks, such as attention control and decision-making, compared with students who did not play videogames. Moreover, there were differences in cognitive flexibility across genres of videogames, with students who reported playing real-time strategy games showing improved performance compared with playing first-person shooter games.

## Aims and Hypotheses

Recent research has reported mixed results in relation to the link between non-problematic video-gaming and mental health difficulties, with both positive (e.g., Johannes et al., 2021) and negative (e.g., Mikuska & Vazsonyi, 2017) results reported. Additionally, although reviews have found a link between video gaming more generally and improved cognitive flexibility (Liu et al., 2011; Reynaldo et al., 2021), there is little research specifically examining whether the genre of videogame impacts on cognitive flexibility. Finally, although research has found differences between genders and depression symptoms in those that play videogames (e.g., Twenge & Farley, 2021), there is lack of literature focusing on adults. The current study aimed to further develop existing research by examining whether increased hours of gaming predicts depression and anxiety symptoms, and cognitive flexibility in a sample of UK adults (defined as 18 years old+), and any differences between genre of game played and gender.

The following hypotheses were tested:

*Hypothesis 1*

Increased frequency of video-gaming, measured by hours of gaming per week, will predict lower levels of depression symptoms, as reported in similar previous studies (e.g., Twenge & Farley, 2021).

*Hypothesis 2*

Increased frequency of video-gaming, measured by hours of gaming per week, will predict lower levels of anxiety symptoms, as reported in similar previous studies (e.g., Pallavicini et al., 2021).

*Hypothesis 3*

Increased frequency of video-gaming, measured by hours of gaming per week, will predict greater cognitive flexibility, as reported in similar previous studies (Reynaldo et al., 2021).

*Hypothesis 4*

There will be group differences for genre on depression and anxiety symptoms, and cognitive flexibility. Due to the lack of research regarding genre differences in the gaming community, a directional hypothesis was not made.

*Hypothesis 5*

There will be group differences for gender (i.e., male vs. female) on depression and anxiety symptoms, and cognitive flexibility. Due to the lack of research regarding gender differences in the gaming community, a directional hypothesis was not made.

# Method

## Design

The study was an online, cross-sectional quantitative study. Ethical approval was obtained from Staffordshire University (see Appendix 1). All participants provided written informed consent before participating.

## Recruitment

In order to be eligible for inclusion in the study, participants had to be adults (i.e., 18 years old+), living in the United Kingdom at the time of data collection, fluent in English (due to lack of translation resources), and report playing a minimum of one hour of videogames per week on either consoles (i.e., Sony PlayStation, Microsoft Xbox etc.) or PC.

Participants were not eligible to participate if they played videogames exclusively on mobile devices, as this is categorised as a separate type of video-gaming (Pan et al., 2019). Participants were also not eligible if they self-reported 'problematic' video-gaming. In the current study, this was determined by asking participants to answer all nine items from the Internet Gaming Disorder Scale – Short-Form (IGDS9-SF; Pontes & Griffiths, 2015). Participants were required to complete the IGDS9-SF as part of the information sheet in order to screen for 'problematic gaming'. The IGDS9-SF is a 9-item self-report measure, utilising a 5-point Likert scale for each item, developed to differentiate disordered and non-disordered gaming. A recent systematic review (Poon et al., 2021) found the IGDS9-SF to have adequate internal consistency, excellent criterion validity, and supported its use in assessing disordered gaming. For this study, it was amended to a simple "yes" or "no" response for each item, instead of the 5-point Likert scale. Participants self-screened themselves using this measure. Participants who answered "yes" to five or more of the nine items were presented with a message that they were no longer eligible to participate, as they were likely to reach the threshold for 'problematic gaming' as defined by the IGDS9-SF. Participants were provided with a link for support around video-gaming addiction if they reached this threshold. The data from the IGDS9-SF as part of the screening process was not collected.

Participants were recruited using a social media advert (see Appendix 2) placed on LinkedIn, Facebook, Reddit, X, and Discord, where a URL link was provided. Sharing was enabled on social media to allow people to share the advert and reach a wider audience. The recruitment window was open for 17 days. The study was hosted on Qualtrics. Participants were asked to read the information sheet (see Appendix 3) and complete the modified IGDS9-SF. If they did not meet criteria of 'problematic gaming', they were asked to complete the consent form. It was not possible to access the study without providing written informed consent. Participants were informed that their data would be anonymised. Participants were provided with information on how to create a unique ID code to allow their data to be withdrawn from the study if requested. Participants then completed the demographics questionnaire (see Appendix 4), and the three psychometric questionnaires (see Appendix 5). After completing the study, participants were provided with debrief information (Appendix 6).

## Measures

### *Demographic Information*

Demographic data was collected in order to characterise the sample and control for any confounding variables. Data was collected on age, gender, and. ethnicity. Age was

categorised (e.g., 18 – 20, 21 – 29, 30 – 39 etc.) to allow for better anonymization of data. Furthermore, two clinical variables were collected (i.e., current illicit substance use; history of psychiatric disorder), to explore the potential impact of these variables on the outcome data. However, inferential statistical analysis was not undertaken, firstly due to the low numbers of participants who reported illicit substance use (10%; *n* = 16) and self-reported history of psychiatric disorder (27%; *n* = 44). Secondly, there was significant heterogeneity in the self-reported history of psychiatric disorder, including co-morbidity and some participants reporting neurodiversity (e.g., ADHD) diagnoses.

### *Gaming Characteristics*

As well as demographic data, data on gaming characteristics were also collected. Data was collected on numbers of hours per week of videogame usage, platform used to play videogames, and genre of videogame predominantly played. Hours per week of videogame usage was categorised (e.g., 1 – 5 hours, 6 – 10 hours, 11 – 15 hours etc.) for data analysis purposes. Platform of gaming was a binary choice of console (i.e., Microsoft Xbox, Sony PlayStation etc.) or PC. Participants were also asked to pick from one of thirteen genres that they most frequently played (e.g., first/third person shooter, action/adventure, sports etc.). There is no exhaustive list of videogame genres, therefore a twelve genre list (Uswitch, 2024), with the added option of “other” included, was utilised.

### *Depression Symptoms*

To measure depression symptoms, the Patient Health Questionnaire Version 9 (PHQ-9; Kroenke et al., 2001) was administered. The PHQ-9 is a 9-item self-report measure, utilising a 4-point Likert scale for each item and corresponds to the Diagnostic and Statistical Manuals (DSM) major depression criteria. It has been validated in a variety of populations, including community (Kocalevent et al., 2013) and psychiatric (Beard et al., 2016) samples, and meta-analyses has been found it to be suitable for different populations in different countries (Gilbody et al., 2007).

### *Anxiety Symptoms*

To measure anxiety symptoms, the Generalised Anxiety Disorder Scale 7 (GAD-7; Spitzer et al., 2006) was administered. The GAD-7 is a 7-item self-report measure, utilising a 4-point Likert scale for each item, developed as a screening tool for generalised anxiety disorder and as a measure for anxiety symptom severity (White & Karr, 2023). It has been used to measure anxiety symptoms in different populations, including psychiatric patients (Beard & Bjorgvinsson, 2014), the general population (Lowe et al., 2008), and college students (Byrd-Bredbenner et al., 2020). It has good internal consistency and test-retest

reliability across different populations (Spitzer et al., 2006; White & Karr, 2023), including when demographic factors such as gender (Sriken et al., 2022) have been considered.

### *Cognitive Flexibility*

To measure cognitive flexibility, the Cognitive Flexibility Inventory (CFI; Dennis & Vander Wal, 2010) was administered. The CFI is a 20-item self-report measure, utilising a 7-point Likert scale for each item. The CFI includes two subscales: 'alternatives' (i.e., the adaptive ability to perceive multiple alternative explanations for life occurrences and the ability to generate alternative solutions to difficult situations), and 'control' (i.e., the extent to which an individual has an internal locus of control[2]). The CFI also has a Total score. As the subscales measure specific aspects of cognitive flexibility, but not cognitive flexibility as a whole, the total score was used instead of the subscales. The CFI has been shown to be a reliable and valid measure (Wuthrich & Rapee, 2014), and translated versions have yielded similar results (e.g., Portoghese et al., 2020). Many cognitive flexibility measures require face-to-face testing and complicated administration, for example the Stroop Test (Stroop, 1935), whereas the CFI allows for quick and easy administration and scoring, as well as reaching a wider audience as it can be administered remotely.

## Power Analysis

To determine the number of participants required, an a-priori power calculation was conducted using G* (Faul et al., 2009). Based on one predictor variable (weekly average hours of gameplay), two separate variables (genre and gender), and three criterion variables (depression symptom levels, anxiety levels, and cognitive flexibility), a medium effect size (0.15), and power and alpha at the conventional 0.8 and 0.05 respectively, 82 participants were required.

## Data Analysis

All responses were transferred from Qualtrics to SPSS. Statistical analysis was carried out using IBM SPSS Statistics (Version 29).

## Data Screening

Although 82 participants were required, a total of 264 participants accessed the study via the URL link. Of the 264 participants, 38% (*n* = 100) had missing data. Within this subsample, the amounts of psychometric data missing ranged from 56% - 75%. None of these participants had commenced the CFI. As such, due to the large amount of missing data where use of multiple imputations would likely have little to no benefit (Lee & Huber,

[2] I.e., the belief that the outcome of events in a person's life are attributed to their own ability, opposed to external factors such as luck (Rotter, 1982).

2021), all 100 were removed, leaving 164 participants. Data was further examined by visual inspection, resulting in the removal of one outlier from the analysis that indicated sham responding. Integrity checks were also carried out, to ensure that there were no responses completed by bots. This was predominantly done by checking the time taken to complete the study. As there were no indicators of bot responses, there were no further removals. This left a final data pool of 163 participants. This data set was complete and therefore no imputations to substitute for missing data were needed.

## Participants

Participant (*N* = 163) demographics are presented in Table 1. Most participants (*n* = 47, 29%) were between 30-34 years old. Most participants were male (*n* = 109, 67%). Most participants identified as white (*n* = 138, 86%). 51% (*n* = 82) of the sample used a PC to game and 49% (*n* = 81) used a console. Most participants (*n* = 46, 28%) played between 6 – 10 hours of video gaming per week. The majority of participants (*n* = 133, n = 82%) played 20 hours per week or less. The genres of games played varied significantly, but the top three most common genres were role playing games (*n* = 55, 34%), first/third person shooter games (*n* = 30, 18%), and action/adventure games (*n* = 23, 14%). Most participants (*n* = 147, 90%) self-reported they had not taken illicit substances in the last week. The majority of participants did not self-report having a diagnosed mental health condition (n = 119; 73%). The majority of participants did not endorse any depression symptoms according to clinical cut-offs for the PHQ-9 (*n* = 91, 56%; see Table 2), or anxiety symptoms according to clinical cut-offs on the GAD-7 (*n* = 101, 62%; see Table 3).

As there were small numbers of participants in some demographic groups, some categories have been collapsed to ensure anonymity, as per guidance (HESA, n.d.). The groups collapsed include age, ethnicity, average hours of gameplay, and genre of game played.

**Table 1**

*Sample Characteristics (N = 163)*

| Demographic Characteristic | N (%) |
|---|---|
| **Participant age** | |
| 18 - 24 | 18 (11%) |
| 25 - 29 | 46 (28%) |
| 30 - 34 | 47 (29%) |
| 35 - 39 | 27 (16%) |
| 40 - 44 | 19 (12%) |
| 45+ | 6 (4%) |
| **Participant gender** | |
| Male | 109 (67%) |
| Female | 50 (31%) |
| Non-binary | 4 (2%) |
| **Diagnosed mental health condition** | |
| No | 119 (73%) |
| Yes | 44 (27%) |
| **Ethnicity** | |
| White British | 115 (72%) |
| White (any other) | 23 (14%) |
| Mixed (White and Black Caribbean) | 5 (3%) |
| Mixed (White and Asian) | 5 (3%) |
| Any Asian or Asian British | 7 (4%) |
| Any Black or Black British | 4 (2%) |
| Any other ethnic group | 4 (2%) |

| | |
|---|---|
| **Platform** | |
| PC | 82 (51%) |
| Console | 81 (49%) |
| **Average hours of gameplay per week** | |
| 1 – 5 hours | 38 (24%) |
| 6 – 10 hours | 46 (28%) |
| 11 – 15 hours | 24 (15%) |
| 16 – 20 hours | 25 (15%) |
| 21 – 25 hours | 9 (6%) |
| 26 – 30 hours | 10 (6%) |
| 31 – 35 hours | 7 (4%) |
| 36+ hours | 4 (2%) |
| **Genre of games played** | |
| Role playing games | 55 (34%) |
| First/third person shooter | 30 (18%) |
| Action/adventure | 23 (14%) |
| Other | 20 (12%) |
| Sports | 9 (6%) |
| Simulation | 9 (6%) |
| Multiplayer online battle arena games | 9 (6%) |
| Sandbox | 4 (2%) |
| Platform | 4 (2%) |
| **Substance misuse** | |
| No | 147 (90%) |
| Yes | 16 (10%) |

**Table 2**

*Clinical cut-off scores for depression symptoms (N = 163)*

| | No depression | Mild depression | Moderate depression | Moderately severe depression | Severe depression |
|---|---|---|---|---|---|
| **Depression symptoms (PHQ-9)** | 91 (56%) | 38 (23%) | 18 (11%) | 11 (7%) | 5 (3%) |

**Table 3**

*Clinical cut-off scores for anxiety symptoms (N=163)*

| | No/minimal anxiety | Mild anxiety | Moderate anxiety | Severe anxiety |
|---|---|---|---|---|
| **Anxiety symptoms (GAD-7)** | 101 (62%) | 42 (26%) | 9 (5%) | 11 (7%) |

## Method of Analysis

Correlations between the study variables were assessed as part of the regression. Linear regression analyses with bootstrapping were run to examine whether weekly average hours of gameplay predicted a decrease in depression and anxiety symptoms, and an increase in cognitive flexibility scores. However, due to the model fitting poorly, two covariates were added (i.e., age and gender) to strengthen the model. This was successful, therefore three multiple regression analyses with bootstrapping are reported below. In addition, two ordinal logistic regression analyses were run for depression and anxiety symptoms, as an alternative analysis strategy using the clinical cut off scores for the PHQ-9 and GAD-7 respectively. As the model fit was again poor, the multiple regression analyses are reported, but the ordinal logistic regressions have been retained in the appendix (see Appendix 16 and 17). Bivariate correlations between variables were produced, including covariates. Three one-way between-group analyses of variance (ANOVA) tests were conducted to examine any group differences between genre of game played on depression

and anxiety symptoms, and cognitive flexibility scores. A further three one-way between-group ANOVA tests were conducted to examine any group differences between gender (i.e., male vs. female) on depression and anxiety symptoms, and cognitive flexibility scores.

### Statistical Assumptions

Data checks were conducted to check if the data significantly violated the assumptions for a regression analysis, including absence of outliers, normality, linearity, homoscedasticity, absence of multicollinearity, and independence of residuals (Field, 2017). The regression tests for depression, anxiety, and cognitive flexibility all violated normality assumptions, therefore bootstrapping was used to address these violations and are reported in the regression model for all three criterion variables. Bootstrapping is a robust re-sampling method that can be used when the sample differs from normality as it does not assume normality. Instead, it estimates the properties of the sampling distribution using the study data (Field, 2017).

Data checks were also conducted to check if the data significantly violated the assumptions for ANOVA tests. The data was not normally distributed, however as the sample size was large enough, the violation should not have negatively skewed the results (Pallant, 2016). No other assumptions were violated.

## Results

### Descriptive Statistics

The mean (M), standard deviation (SD), and range for the criterion variables are presented in Table 4.

**Table 4**

*Descriptive statistics for the criterion variables (N = 163)*

| | M | SD | Range |
|---|---|---|---|
| **Depression symptoms (PHQ-9)** | 5.81 | 5.69 | 0 - 27 |
| **Anxiety symptoms (GAD-7)** | 4.69 | 4.99 | 0 - 21 |
| **Cognitive flexibility (CFI)** | 108.16 | 16.36 | 55 - 140 |

## Correlations

Table 5 shows the pooled bivariate Pearson *r* correlations between all variables in the regression analyses, including the two covariates. A significant negative correlation was found between age and depression, suggesting that as participants age they reported significantly fewer depression symptoms ($r = -.17$, $p < .05$). A significant strong negative correlation was found between age and anxiety symptoms, suggesting that as participants age they reported significantly fewer anxiety symptoms ($r = -.22$, $p < .01$). A significant strong positive correlation was found between age and cognitive flexibility, suggesting that as participants age their cognitive flexibility improved ($r = .23$, $p < .01$).

A significant strong positive correlation was found between depression symptoms and anxiety symptoms ($r = .81$, $p < .001$), suggesting that participants reporting higher depression symptoms also reported higher anxiety symptoms. In addition, a significant strong negative correlation was found between depression symptoms and cognitive flexibility, suggesting that participants reporting higher levels of depression symptoms reported poorer cognitive flexibility ($r = -.39$, $p < .001$). Finally, a strong negative correlation was found between anxiety symptoms and cognitive flexibility, indicating that participants reporting higher levels of anxiety symptoms reported poorer levels of cognitive flexibility ($r = -.42$, $p < .001$). There were no significant correlations between any other study variables.

**Table 5**

*Pearson's r correlations for the study variables (N = 163)*

| Variable | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **1. Age** | - | | | | | |
| **2. Gender** | -.11 | - | | | | |
| **3. Hours of gameplay** | -.14 | -.03 | - | | | |
| **4. Depression symptoms (PHQ-9)** | -.17* | .08 | .05 | - | | |
| **5. Anxiety symptoms** | -.22** | -.15 | -.07 | .81*** | - | |
| **6. Cognitive flexibility (CFI)** | .23** | -.12 | .03 | -.39*** | -.42*** | - |

*Note: *p < .05, **p < .01, ***p < .001*

## Multiple Regression Analysis

### *Hypothesis One - Depression Symptoms*

A multiple regression analysis was conducted with hours of gaming per week as the predictor variable, and depression symptoms measured using the PHQ-9 as the criterion variable (Table 6; Appendix 7), with age and gender included in the model as covariates.

The regression model was not significant ($F$ (159, 3) = 1.85, $p$ = .14) accounting for 3% (2% when adjusted) of the total variance in depression symptoms. As such, hypothesis 1 was not supported. The initial analysis showed that hours of video-gaming per week was not a significant predictor of depression (β = .03, $p$ = .747). However, due to the violation in normality, the model was rerun using Bootstrapping (Table 6; Appendix 7). The bootstrapped confidence interval levels were similar to those in the original model, suggesting that the degree of violation was not too significant for the model. The bootstrapped results also showed that hours of gameplay per week was not a significant predictor of depression symptoms ($p$ = .763). However, it should be recognised that within the added covariates, age was a significant predictor of lower depression symptoms (β = -.16, $p$ = .044), including when bootstrapped ($p$ = .045).

**Table 6**

*Multiple regression analysis of hours of video-gaming per week as a predictor of depression symptoms, with and without bootstrapping (N = 163), with age and gender included as covariates.*

| | Multiple Regression | | | | | | Bootstrapping | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | SE B | β | Sig. | 95% CI | | Bias | SE B | Sig. | 95% BCa CI | |
| | | | | | Lower | Upper | | | | Lower | Upper |
| **Constant** | 6.64 | 1.86 | | <.001 | 2.97 | 10.30 | .09 | 1.82 | <.001 | 3.06 | 10.46 |
| **Age** | -.65 | .32 | -.16 | .044 | -1.28 | -.02 | <.01 | .32 | .045 | -1.22 | .05 |
| **Gender** | .68 | .84 | .06 | .425 | -.99 | 2.34 | -.04 | .86 | .411 | -1.17 | 2.36 |
| **Hours of gaming per week** | .07 | .23 | .03 | .747 | -.38 | .53 | -.01 | .24 | .763 | -.39 | .58 |

*Note: $R^2$ = 3%; Adjusted $R^2$ = 2%. Unstandardised coefficient, standard error, standardised coefficient, significant values, and confidence intervals are presented, along with the bootstrapped comparison including bias-corrected accelerated confidence intervals. Bootstrap results are based on 1000 samples.*

*Hypothesis Two - Anxiety Symptoms*

A second multiple regression was conducted with hours of gaming per week as the predictor variable, and anxiety symptoms measured using the GAD-7 as the criterion variable (Table 7; Appendix 8), with age and gender included in the model as covariates.

The regression model was significant ($F$ (159, 3) = 4.20, $p$ = .007) accounting for 7% (6% when adjusted) of the total variance in anxiety symptoms. The results indicate that hypothesis two was not supported, as the initial analysis showed that hours of video-gaming per week was not a significant predictor of anxiety symptoms (β = -.10, $p$ = .201). However, due to the violation in normality, the model was rerun using Bootstrapping (Table 7; Appendix 8). The bootstrapped confidence interval levels were similar to those in the original model, suggesting that the degree of violation was not too significant for the model. The bootstrapped results also showed that hours of gameplay per week was not a significant predictor of anxiety symptoms ($p$ = .200). However, it should be recognised that within the added covariates, the results show that age was a significant predictor of lower anxiety symptoms (β = -.22, $p$ = .005), including when bootstrapped ($p$ = .005).

**Table 7**

*Multiple regression analysis of hours of video-gaming per week as a predictor of anxiety symptoms, with and without bootstrapping (N = 163), with age and gender included as covariates.*

| | Multiple Regression | | | | | | Bootstrapping | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | SE B | β | Sig. | 95% CI | | Bias | SE B | Sig. | 95% BCa CI | |
| | | | | | Lower | Upper | | | | Lower | Upper |
| **Constant** | 6.28 | 1.59 | | <.001 | 3.12 | 9.42 | -.01 | 1.51 | <.001 | 3.47 | 9.48 |
| **Age** | -.78 | .27 | -.22 | .005 | -1.32 | -.24 | -.01 | .26 | .005 | -1.30 | -.32 |
| **Gender** | 1.14 | .72 | .12 | .119 | -.29 | 2.57 | -.02 | .72 | .126 | -.27 | 2.55 |
| **Hours of gaming per week** | -.25 | .20 | -.10 | .201 | -.64 | .14 | .01 | .20 | .200 | -.63 | .15 |

*Note: $R^2$ = 7%; Adjusted $R^2$ = 6%. Unstandardised coefficient, standard error, standardised coefficient, significant values, and confidence intervals are presented, along with the bootstrapped comparison including bias-corrected accelerated confidence intervals. Bootstrap results are based on 1000 samples.*

*Hypothesis Three - Cognitive Flexibility*

A third multiple regression was conducted with hours of gaming per week as the predictor variable, and cognitive flexibility measured using the CFI Total score as the criterion variable (Table 8; Appendix 9), with age and gender included in the model as covariates.

The regression model was significant ($F$ (159, 3) = 3.71, $p$ = .013) accounting for 7% (5% when adjusted) of the total variance in cognitive flexibility. The results indicate that hypothesis three was not supported, as the initial analysis showed that hours of video-gaming per week was not a significant predictor of cognitive flexibility (β = .06, $p$ = .463). However, due to the violation in normality, the model was rerun using Bootstrapping (Table 8; Appendix 9). The bootstrapped confidence interval levels were similar to those in the original model, suggesting that the degree of violation was not too significant for the model. The bootstrapped results also showed that hours of video-gaming per week was not a significant predictor of cognitive flexibility ($p$ = .446). However, it should be recognised that within the added covariates, the results show that age was a significant predictor of cognitive flexibility (β = .23, $p$ = .004), including when bootstrapped ($p$ = .004).

**Table 8**

*Multiple regression analysis of hours of video-gaming per week as a predictor of cognitive flexibility, with and without bootstrapping (N = 163), with age and gender included as covariates.*

| | Multiple Regression | | | | | | Bootstrapping | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | SE B | β | Sig. | 95% CI | | Bias | SE B | Sig. | 95% BCa CI | |
| | | | | | Lower | Upper | | | | Lower | Upper |
| **Constant** | 102.36 | 5.25 | | <.001 | 91.99 | 112.72 | .20 | 5.47 | <.001 | 91.51 | 113.68 |
| **Age** | 2.66 | .90 | .23 | .004 | .88 | 4.44 | .04 | .88 | .004 | 1.09 | 4.47 |
| **Gender** | -2.76 | 2.39 | -.09 | .249 | -7.48 | 1.96 | -.17 | 2.49 | .265 | -7.95 | 1.63 |
| **Hours of gaming per week** | .48 | .65 | .06 | .463 | -.80 | 1.76 | -.03 | .59 | .446 | -.79 | 1.49 |

*Note: $R^2$ = 7%; Adjusted $R^2$ = 5%. Unstandardised coefficient, standard error, standardised coefficient, significant values, and confidence intervals are presented, along with the bootstrapped comparison including bias-corrected accelerated confidence intervals. Bootstrap results are based on 1000 samples.*

## Analysis of Variance

### *Genre ANOVAs*

To explore any group differences between the genre of game played on depression and anxiety symptoms, and cognitive flexibility, three one-way analysis of variance tests (ANOVAs) were carried out. Whilst there were 12 categories of genre, due to the very small numbers of participants endorsing playing some genres, the three top genres were selected for the ANOVAs, and all other genres were collapsed into 'other' to ensure the assumption of homogeneity of variance was not violated.

**Table 9**

*Genres (N = 163) used in ANOVA analyses*

| Genre of games played | N (%) |
|---|---|
| Role playing games | 55 (34%) |
| First/third person shooter | 30 (18%) |
| Action/adventure | 23 (14%) |
| Other | 55 (34%) |

### Hypothesis Four - Genre and Depression Symptoms

A one-way ANOVA was conducted to determine if there were any statistically significant differences in depression symptoms, as measured using the PHQ-9, among the four genre groups. There were no statistically significant differences in depression symptoms between each of the four genre groups: $F$ (3, 159) = 1.85, $p$ = .141; partial eta squared = .03 (Appendix 10).

### Hypothesis Four - Genre and Anxiety Symptoms

A one-way ANOVA was conducted to determine if there were any statistically significant differences in anxiety symptoms, as measured using the GAD-7, among the four genre groups. There were no statistically significant differences in anxiety symptoms between each of the four genre groups: $F$ (3, 159) = 1.49, $p$ = .217; partial eta squared = .03 (Appendix 11).

### Hypothesis Four - Genre and Cognitive Flexibility

A one-way ANOVA was conducted to determine if there were any statistically significant differences in cognitive flexibility, as measured using the CFI, among the four genre groups.

There were no statistically significant differences in the CFI scores between each of the four genre groups: $F$ (3, 159) = .80, $p$ = .495; partial eta squared = .02 (Appendix 12).

### *Gender ANOVAs*

To explore any group differences between gender on depression and anxiety symptoms, and cognitive flexibility, a further three ANOVA tests were carried out. As there were only a very small number of participants who identified as non-binary ($n$ = 4, 2%), these were omitted from analysis to ensure the assumption of homogeneity of variance was not violated. Consequently, the analysis only compared male vs. female participants.

#### Hypothesis Five – Gender and Depression Symptoms

A one-way ANOVA was conducted to determine if there were any statistically significant differences in depression symptoms, as measured using the PHQ-9, among two gender groups. There were no statistically significant differences in depression symptoms between genders: $F$ (1, 157) = .11, $p$ = .744; partial eta squared = <.01 (Appendix 13).

#### Hypothesis Five – Gender and Anxiety Symptoms

A one-way ANOVA was conducted to determine if there were any statistically significant differences in anxiety symptoms, as measured using the GAD-7, among two gender groups. There were no statistically significant differences in anxiety symptoms between genders: $F$ (1, 157) = 1.55, $p$ = .215; partial eta squared = .01 (Appendix 14).

#### Hypothesis Six – Gender and Cognitive Flexibility

A one-way ANOVA was conducted to determine if there were any statistically significant differences in cognitive flexibility, as measured using the CFI, among two gender groups. There were no statistically significant differences in cognitive flexibility between genders groups: $F$ (1, 157) = 2.61, $p$ = .108; partial eta squared = .02 (Appendix 15).

## Discussion

### Findings

This study investigated whether hours of videogame play in a non-problematic video-gaming sample predicted lower depression and anxiety symptoms, and increased cognitive flexibility. This study also investigated whether there were any group differences between genres of videogame being played and depression and anxiety symptoms, and cognitive flexibility. Finally, this study investigated whether there were any group differences between gender and depression and anxiety symptoms, and cognitive flexibility.

The first and second hypotheses, that increased non-problematic gaming would predict lower levels of depression symptoms and anxiety, was not supported. The results show that increased video-gaming did not predict a decrease in depression symptoms or anxiety symptoms, similar to a larger scale study (Li et al., 2023). It is possible that the reason for this is due to floor effects. This study did not recruit individuals who play video-games who have a diagnosis of depression and/or anxiety. Some research that has focused on video-gamers with depression (Li et al., 2016) and anxiety (Pallavicini et al., 2021), have shown reduced symptoms when they engage in non-problematic video-gaming. It may be that non-problematic video-gaming predicts lower depression and/or anxiety scores in those who have a formal psychiatric diagnosis, but it does not predict any reduction in those who do not meet diagnostic thresholds.

Additionally, a recent study (Di Blasi et al., 2019) found that the relationship between mental health difficulties and 'problematic gaming' was complex, suggesting that video-gaming does not predict mental health difficulties but instead individuals with mental health difficulties use videogames to cope. Consequently, this may explain the lack of significance between depression and anxiety symptoms and increased video-gaming; "moderate" video-gaming (as defined within the Goldilocks Hypothesis; Przybylski & Weinstein, 2017) may benefit those with depression and anxiety diagnoses, as long as they do not breach the 'problematic gaming' threshold. Additionally, the majority of studies in this area, despite using adolescents (e.g., Twenge & Martin, 2020) or focusing on 'problematic gaming' (e.g., Liu et al., 2018), have used much larger samples ($N$ = 221,096 and $N$ = 702 respectively). It may be that it was not possible to detect any significant results due to the smaller sample size in this study.

The third hypothesis, that increased hours of non-problematic video-gaming would predict better cognitive flexibility, was also not supported, as increased hours of video-gaming did not predict an increase in cognitive flexibility scores, despite previous studies finding that playing videogames can improve cognitive flexibility (e.g., Liu et al., 2011). Most studies exploring the relationship between videogames and cognitive flexibility focus on those who do not play videogames versus those who do (e.g., Chisholm & Kingston, 2015), but no known studies have examined how cognitive flexibility may change as video-gaming increases. It may be that any videogame usage improves cognitive flexibility, but increased usage has no further benefits. Additionally, no known studies used the CFI as a measure, instead using measures such as the Wisconsin card sorting task (Buelow et al., 2015) and Task switching tasks (Dobrowolski et al., 2015). Consequently, it maybe that the CFI measures how a person perceives their cognitive flexibility, as opposed to an objective measure.

The fourth hypothesis, that there would be a difference in depression symptoms, anxiety symptoms, and cognitive flexibility, between different genres of video-games played, was also not supported. Most studies typically categorise videogames as a singular category (e.g., Maras et al., 2015; Mikuska & Vazsonyi, 2017), as opposed to individual genres that may be associated with different effects on the player. The literature exploring the impact of different genres on mental health outcomes has found mixed results. For example, there are consistent and positive associations between increased frequency of video-gaming and fewer depression and anxiety symptoms in people who play 'active' games, also known as 'exergames', such as Wii Sport games and Microsoft Kinect games (Weybright et al., 2010; Zheng et al., 2020). Additionally, 'exergames' as a genre have been found to improve cognitive functioning (Stanmore et al., 2017). Research has shown some evidence that violence within videogames can increase stress levels (e.g., Porter & Goolkasian, 2019), but violence can span several genres and is not a genre in of itself. A review of the empirical literature (Boldi & Rapp, 2022) has shown some genres can be targeted towards improving mental health difficulties. For example, puzzle games (Kessler et al., 2020) and first-person shooter games (Carras et al., 2018) have been shown to reduce intrusions and re-processing trauma memories, respectively, in people with PTSD symptoms. Multiplayer games were found to be beneficial by increasing social contact (Lufkin, 2020; Zhu, 2020). The role-playing game (RPG) genre however has been associated with 'problematic gaming' (Elliot et al., 2012) and subsequent increase in depression and anxiety symptoms. It is possible that this study did not find any significant differences in depression, anxiety, and cognitive flexibility between videogame genres due to the low number of responses in many of the genre groups.

The fifth hypothesis, that there would be a difference between genders and depression and anxiety symptoms, as well as cognitive flexibility scores, was also not supported. Although limited, previous research has suggested that there may be gender differences in videogame players in terms of their mental health. For example, research has found that stress can increase more so in adolescent female video-gamers when playing violent videogames compared to adolescent male video-gamers (Ferguson et al., 2016). Furthermore, some studies have shown evidence of lower anxiety symptoms in adolescent males but higher anxiety symptoms in adolescent females with increased video-gaming (Ohannessian, 2018), as well as more depression symptoms for adolescent male video-gamers (Twenge & Farley, 2021). However, these studies included much larger sample sizes compared to the current study, as well as only focusing on adolescents.

## Limitations

While there were participants who identified as male, female, and non-binary in this study, the number of male video-gamers (67%) in this study was much larger than female (31%) and non-binary (2%) video-gamers. As such, it may possible that the results of the current study are not generalisable to non-male video-gamers. It is recognised that the population of video-gamers is diverse (Chess et al., 2016), yet this study presents results from a predominantly male sample.

Additionally, this study relied solely on online responses. Although it does not exclude any video-gamers, as video-gamers usually require the internet, it does raise the issue of reliability. Research has shown that unreliable responses are more likely in online studies (Lefever et al., 2006). Additionally, this study relied on individuals self-screening themselves out if they met the criteria for 'problematic gaming'. It is difficult to ascertain whether participants accurately screened themselves out. This study also aimed to recruit a sample size required to detect a medium sized effect. However, a larger sample was recruited. Despite this, the study is unlikely to be overpowered as comparatively, the sample size is smaller than similar studies (e.g., Twenge & Farley, 2021).

When reviewing the data from the initial regression analysis, the normality assumptions were violated. Furthermore, the amount of variability in the data accounted for in the regression models was very small, suggesting that there are likely to have been other factors that could have impacted on the results that were not measured in this study. Other research has found that factors such as social isolation (Wolters et al., 2023) can contribute to increased depression symptoms, with poorer sleep contributing to increased anxiety symptoms (Simonetti et al., 2021), and adverse childhood experiences impairing cognitive flexibility in adulthood (Kalia et al., 2021). As these factors, amongst others, were not included in this study, it may explain why the model fit poorly. Generally, the results should be interpreted with caution.

It should also be noted that the measure of cognitive flexibility, the CFI, is a self-report measure. Cognitive flexibility is usually measured using objective tests that require practical tasks, such as the Stroop test (Stroop, 1935). Using the CFI is beneficial, as it can easily be administered without the need for face-to-face testing. As the CFI has not been compared with more objective tasks aimed at measuring cognitive flexibility, it is possible that it measures participants' perception of their own cognitive flexibility and therefore the results may not a true reflection of cognitive flexibility.

Finally, it is recognised that the data collected on hours of video-gaming per week was categorical in nature. If the data had been continuous (i.e., by asking participants to type the

number of hours they play videogames per week), it may have helped to elucidate any dose-response relationships.

## Clinical Implications

Whilst there is little research investigating the impact of increased non-problematic videogame usage, particularly in adult populations, the current study suggests that hours of gaming does not predict a reduction in depression nor anxiety symptoms in a sample of UK adults. The empirical literature on how gaming impacts mental health is mixed, with some reporting negative effects (Kim & Ahn, 2016) and some reporting positive effects (Fish et al., 2018; Kuhn et al., 2018). However, the literature is clear that 'problematic gaming' is associated with poorer mental health (Elliot et al., 2012).Within clinical populations who report mental health difficulties such as depression and anxiety, it would be useful to ascertain whether they engage in playing videogames as a hobby. For individuals that do, it may be beneficial to administer the IGDS9-SF to ascertain if they meet the threshold for 'problematic gaming'. Additionally, due to the inconsistency of the literature to date, it would also be useful to ask service users about the perceived impact of video-gaming on their wellbeing in addition to formal screening to elicit any potentially beneficial effects.

Additionally, this research found no difference specifically between genders when it came to depression and anxiety symptoms, and cognitive flexibility scores. Research into adolescent videogame players has suggested that there are differences between genders and depression symptoms (e.g., Twenge & Farley, 2021). Twenge & Farley (2021) found that increased frequency of video-gaming did increase depression symptoms in both genders, but depression symptoms were significantly higher in males. Although they used a much larger sample size ($N$ = 11,427) and only focused on adolescents, the present study offers tentative evidence that in adulthood, these differences are no longer present.

## Future Research

As this study needed to combine genres played due to low numbers, it would be useful for future research to explore the specific interactions between videogame genres and mental health difficulties. Recent research has found that active (or 'exergames) can improve depression symptoms (Zheng et al., 2020), anxiety symptoms (Viana et al., 2017), and cognitive functioning (Stanmore et al., 2017). However, although research exists into the RPG genre, most other genres have had very little exploration. It would be useful for

research with a larger sample size, recruiting videogame players who play each genre, to explore this in more detail.

It would also be useful to focus future research on videogame players who identify as female or non-binary/third genders. The majority of research into video gaming focuses on White, male gamers (Shaw, 2011), despite the literature recognising that this does not reflect the current demographic (Williams et al., 2008; Lopez-Fernandez et al., 2019). To fully understand the impact of video-gaming, it would be useful to attempt to focus specifically on non-male genders. This is particularly relevant given there were no significant differences between genders in this study, as it may mean that differences found in adolescents are no longer present.

Additionally, it would be beneficial to replicate this study with participants who have a diagnosis of depression and/or anxiety. This study has shown that increased video-gaming does not predict a reduction in depression or anxiety symptoms in a sample that predominantly did not meet the threshold for formal diagnosis, however this may differ in individuals who do have a formal diagnosis. Further exploration of video-gaming in adult populations with established diagnoses will help to understand any benefits. When doing so, it would be useful to include a measure of cognitive flexibility that does not rely on self-report, such as the Stroop test (Stroop, 1935) or the Wisconsin Card Sort test (Grant & Berg, 1948). This may give more accurate results of any change in cognitive flexibility in those who play videogames.

Finally, as this research found that depression and anxiety symptoms significantly reduced, and cognitive flexibility significantly increased, as adult non-problematic videogame players' age, it would be beneficial to understand whether these changes continues into older adulthood. It is recognised that greater cognitive flexibility is associated with better quality of life in older adults (Davis et al., 2010). However, cognitive flexibility tends to worsens as adults age (Xia et al., 2024). This study raises the possibility that non-problematic video gaming may reduce this worsening. As adults in the UK who play videogames are soon to reach older age, it would be useful to understand whether non-problematic gaming continues to show the same benefits. If it does improve cognitive flexibility in older adults, it may be useful to incorporate into interventions targeting neurological conditions that are known to reduce cognitive flexibility, such as Alzheimer's disease (El Haj et al., 2015).

## Conclusion

This study has added to the limited empirical evidence base of the impact of non-problematic video-gaming on depression symptoms, anxiety symptoms, and cognitive flexibility in UK adults. The study did not show significant results in relation to increased hours of video-gaming predicting lower depression symptoms, anxiety symptoms, or cognitive flexibility. It also showed no significant group differences between genre of videogame played or gender of the video-gamer. It is possible this was due to floor effects within the sample, frequency of video-gaming data being categorical instead of continuous data, or the study being cross-sectional in design. Future research should focus on diversifying the participant pool, and recruiting participants who are already struggling with mental health difficulties to understand if non-problematic video-gaming reduces their symptoms.

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# Appendices

## Appendix 1 – Ethics approval

School of Health, Education, Policing and Sciences

ETHICAL APPROVAL FEEDBACK

| | |
|---|---|
| **Researcher name:** | Robert McGrath |
| **Title of Study:** | Video games, mental health, and cognitive flexibility: an exploratory study. |
| **Status of approval:** | Approved |

Thank you for addressing the committee's comments. Your research proposal has now been approved by the Ethics Panel and you may commence the implementation phase of your study. You should note that any divergence from the approved procedures and research method will invalidate any insurance and liability cover from the University. You should, therefore, notify the Panel of any significant divergence from this approved proposal. This approval is only valid for as long as you are registered as a student at the University.

You should arrange to meet with your supervisor for support during the process of completing your study and writing your dissertation.

When your study is complete, please send the ethics committee an end of study report. A template can be found on the ethics BlackBoard site.

**Signed:** **Date: 04.03.2024**

Dr Jade Elliott

Ethics Co-ordinator
Psychology
School of Health, Science and Wellbeing

**Appendix 2 – Social media advert**

**Appendix 3 – Information sheet**

## Participant Information Sheet

*Project Reference Number: SU_23_077*

**Title of study:** Video games, mental health, and cognitive flexibility: an exploratory study.

**Invitation Paragraph**

My name is Robert McGrath, and I'm a Trainee Clinical Psychologist. I would like to invite you to participate in this research project which forms part of my Doctorate in Clinical Psychology. Before you decide whether you want to take part, it is important for you to understand why the research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others if you wish.

**What is the purpose of the study?**

There is currently a gap in our understanding of the way video games impact those who play them. It is recognised that some people can become addicted to video games, which negatively impacts their mental health. However, there is conflicting research about how casual gaming impacts people, with some reports stating it can benefit our mental health and some stating it does not. It is therefore important to clarify the impact it can have for casual gamers.

Additionally, it is important for us to understand if there are any other impacts. One of these is a term called "Cognitive flexibility". This is a way in which people think and problem solve during stressful events. Some research has shown that those who play video games have better cognitive flexibility, but this has not been broken down between different genres of games. This research hopes to contribute to this gap in our knowledge.

**Why have I been invited to take part?**

You have been invited to take part in this study because you are an adult (i.e., 18+ years of age) who self-reports playing video games, on either a console or a PC, for at least one hour a week. Additionally, you must live in the UK and English must be your first language.

Additionally, the researchers ask you to consider whether your gaming would qualify as “problematic”. To do this please look at the below questions. Do you consider yourself to engage in problematic gaming, based on:

1. Do you feel preoccupied with your gaming behaviour?
2. Do you feel more irritability, anxiety or even sadness when you try to either reduce or stop your gaming activity?
3. Do you feel the need to spend increasing amount of time engaged in gaming in order to achieve satisfaction or please?
4. Do you systematically fail when trying to control or cease your gaming activity?
5. Have you lost interests in previous hobbies and other entertainment activities as a result of your engagement with the game?
6. Have you continued your gaming activity despite knowing it was causing problems between you and other people?
7. Have you deceived any of your family members, therapists or others because of the amount of your gaming activity?
8. Do you play in order to temporarily escape or relieve a negative mood (e.g. helplessness, guilt, anxiety)?
9. Have you jeopardized or lost an important relationship, job or educational or career opportunity because of your gaming activity?

If you answered “Yes” to five or more of the above questions, you are not eligible to participate in this study.

If you did answer “Yes” to five or more of the above questions, and feel like you would like some support in reducing the amount of gaming, please visit The National Centre

for Gaming Disorders website (https://www.cnwl.nhs.uk/national-centre-gaming-disorders) where you can find specific support.

**What will happen if I take part?**

If you agree to take part in this research and did not answer "Yes" to five or more of the above questions, you will be asked to sign a consent form and complete four different questionnaires. This should take no longer than 20 minutes. These questionnaires focus on different things, ranging from demographic questions, how much you play games, your mood and one about cognitive flexibility.

All the results from these questionnaires will be kept confidential. The results will then be analysed, and may be written up for publication. However, none of the personal details that you give will be used and the data shared will not identify you in any way.

**Do I have to take part?**

No. Participation is completely voluntary. You should only take part if you want to and choosing not to take part will not disadvantage you in anyway. Once you have read the information sheet, please contact me if you have any questions that will help you make a decision about taking part. If you decide to take part, I will ask you to sign a consent form and you will be given an information sheet which will detail ways for you to withdraw if you would like to.

**What are the possible risks of taking part?**

There are no physical risks associated with taking part in this research. It is possible, however, that you may feel some discomfort whilst completing the questionnaires if there are specific ones you may find more difficult than others. If you feel upset about being associated with this research or you have any unpleasant memories and/or feelings, support information will be provided at the end, or via the researcher on request.

**What are the possible benefits of taking part?**

There are no immediate benefits of taking part in this research. However, it will contribute to the wider knowledge about the impact of video games on those who play them.

**Data handling and confidentiality**

Your data will be processed in accordance with the data protection law and will comply with the General Data Protection Regulation 2016 (GDPR).

To ensure anonymity, you will be given a unique identification number that will correspond to the answers that you give. This will ensure that no answers can be traced back to you as an individual. All documentation will be stored remotely. Any data that is downloaded to be analysed will be kept on a secure laptop. Any data will be stored for 10 years before being destroyed, as per the current guidance. Your information will not be shared with any third parties, or outside of the EU.

**Data Protection Statement**

The data controller for this project will be Staffordshire University. The University will process your personal data for the purpose of the research outlined above. The legal basis for processing your personal data for research purposes under the data protection law is a 'task in the public interest' You can provide your consent for the use of your personal data in this study by completing the consent form that has been provided to you.

You have the right to access information held about you. Your right of access can be exercised in accordance with the GDPR. You also have other rights including rights of correction, erasure, objection, and data portability. Questions, comments and requests about your personal data can also be sent to the Staffordshire University Data Protection Officer. If you wish to lodge a complaint with the Information Commissioner's Office, please visit www.ico.org.uk.

**What if I change my mind about taking part?**

You are free withdraw at any point of the study, without having to give a reason. Withdrawing from the study will not affect you in any way. You are able to withdraw your data from the study up until 28 days after you have participated, after which

withdrawal of your data will no longer be possible due to the analysis of the results. Publication of this research will not identify you in any way and the results of the study will be presented at group-level (e.g., averages, percentages) and so it will not be possible to identify individuals.

If you choose to withdraw from the study within 28 days of participating, we will not retain any information that you have provided us as a part of this study, and it will be destroyed in-line with the Staffordshire University policy.

If you decide to withdraw from the study, please send an email to: mw002215@student.staffs.ac.uk. If you do so, please quote your unique participant ID phrase that you will create when you participate. This will then allow your data to be removed.

**How is the project being funded?**

This project is being funded by Staffordshire University, as part of the Doctorate in Clinical Psychology course.

**What will happen to the results of the study?**

The results of this study will be written up for submission as part of the Doctorate in Clinical Psychology course. Once completed, the study will be submitted for publication to a relevant academic journal, which if accepted will be published and can be accessed via online search engines. Publication of this research will not identify you in any way and the results of the study will be presented at group-level (e.g., averages, percentages) and so it will not be possible to identify individuals. No individual data will be reported.

**Your individual results will not be shared with anyone, meaning only the research team will have access to them. They will also not be used to make any diagnoses.**

**Who should I contact for further information?**

If you have any questions or require more information about this study, please contact me on the contact details below (Rob McGrath – Chief Investigator):

Mw002215@student.staffs.ac.uk.

**What if I have further questions, or if something goes wrong?**

If this study has harmed you in any way or if you wish to make a complaint about the conduct of the study you can contact the study supervisor or the Chair of the Staffordshire University Ethics Committee for further advice and information:

Dr. Nachi Chockalingham,
Director of Research
Research, Innovation and Impact Services
Staffordshire University
Leek Road Campus
32 Leek Road
Stoke-on-Trent
ST4 2RU
N.Chockalingham@staffs.ac.uk

**Thank you for reading this information sheet and for considering taking part in this research.**

**Appendix 4 – Demographic questions**

## Demographics questionnaire

1. What is your age?

   ☐18 – 24

   ☐25 – 29

   ☐30 – 34

   ☐35 – 39

   ☐40 – 44

   ☐45 – 49

   ☐50 – 54

   ☐55 – 59

   ☐60+

2. Which option best describes your gender?

   ☐Male

   ☐Female

   ☐Non-binary

   ☐Prefer to self-describe

   _____

3. Do you have a diagnosed mental health condition?

   ☐Yes (proceed to 4)

   ☐No (proceed to 6)

4. If yes, what is it?

_____

_____

_____

5. If yes, please list any medication you have been prescribed for this diagnosis?

_____

_____

_____

6. What is your ethnicity?

**Asian or Asian British**

Indian

Pakistani

Bangladeshi

Chinese

Any other Asian background

**Black, Black British, Caribbean or African**

Caribbean

African

Any other Black, Black British or Caribbean background

**Mixed or multiple ethnic groups**

White and Black Caribbean

White and Black African

White and Asian

Any other Mixed or multiple ethnic groups

**White**

English, Welsh, Scottish, Northern Irish or British

Irish

Gypsy or Irish Traveller

Roma

Any other White background

**Other ethnic group**

Arab

Any other ethnic group

7. What platform do you play video games on the most?

    ☐Console (i.e., PS5/Xbox Series X/Nintendo Switch)

    ☐PC

8. How many hours on average, per week, do you game?

    ☐1 – 5 hours

    ☐6 – 10 hours

    ☐11 – 15 hours

    ☐16 – 20 hours

    ☐21 – 25 hours

    ☐26 – 30 hours

☐31 – 35 hours

☐36 – 40 hours

☐41 – 45 hours

☐46 – 50 hours

☐50+ hours

9. What genre of game do you **usually** play (please pick **one**)?

☐Role play games (RPG) (e.g., Final Fantasy, WoW, Elder Scrolls V: Skyrim)

☐Sandbox games (e.g., Minecraft)

☐Horror games (e.g., Silent Hill 2)

☐Sports games (e.g., FIFA, Madden, Football Manager)

☐Racing games (e.g., Formula 1, Gran Turismo, Forza Horizon)

☐Action/Adventure games (e.g., Uncharted, The Last of Us, God of War)

☐Fighting games (e.g., Mortal Kombat, Tekken)

☐Platformer games (e.g., Crash Bandicoot, Hollow Knight)

☐Simulation games (e.g., Flight simulator, The Sims)

☐Real-time strategy games (e.g., StarCraft, Civilization, Command & Conquer)

☐First/Third person shooter games (e.g., CoD, Battlefield, Overwatch, Gears of War)

☐Multiplayer online battle arena (MOBA) games (e.g., DOTA, League of Legends)

☐Other (please specify)

_____

10. Have you taken any illicit substances (i.e., non-prescribed drugs) in the last week?

☐Yes

☐No

11. If yes, what have you taken?

_____

## Appendix 5 – Psychometrics used

PHQ-9

**PATIENT HEALTH QUESTIONNAIRE-9 (PHQ-9)**

| Over the last 2 weeks, how often have you been bothered by any of the following problems? *(Use "✔" to indicate your answer)* | Not at all | Several days | More than half the days | Nearly every day |
|---|---|---|---|---|
| 1. Little interest or pleasure in doing things | 0 | 1 | 2 | 3 |
| 2. Feeling down, depressed, or hopeless | 0 | 1 | 2 | 3 |
| 3. Trouble falling or staying asleep, or sleeping too much | 0 | 1 | 2 | 3 |
| 4. Feeling tired or having little energy | 0 | 1 | 2 | 3 |
| 5. Poor appetite or overeating | 0 | 1 | 2 | 3 |
| 6. Feeling bad about yourself — or that you are a failure or have let yourself or your family down | 0 | 1 | 2 | 3 |
| 7. Trouble concentrating on things, such as reading the newspaper or watching television | 0 | 1 | 2 | 3 |
| 8. Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual | 0 | 1 | 2 | 3 |
| 9. Thoughts that you would be better off dead or of hurting yourself in some way | 0 | 1 | 2 | 3 |

FOR OFFICE CODING 0 + _____ + _____ + _____

=Total Score: _____

If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

| Not difficult at all | Somewhat difficult | Very difficult | Extremely difficult |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

Developed by Drs. Robert L. Spitzer, Janet B.W. Williams, Kurt Kroenke and colleagues, with an educational grant from Pfizer Inc. No permission required to reproduce, translate, display or distribute.

GAD-7

# GAD-7 Anxiety

| Over the last two weeks, how often have you been bothered by the following problems? | Not at all | Several days | More than half the days | Nearly every day |
|---|---|---|---|---|
| 1. Feeling nervous, anxious, or on edge | 0 | 1 | 2 | 3 |
| 2. Not being able to stop or control worrying | 0 | 1 | 2 | 3 |
| 3. Worrying too much about different things | 0 | 1 | 2 | 3 |
| 4. Trouble relaxing | 0 | 1 | 2 | 3 |
| 5. Being so restless that it is hard to sit still | 0 | 1 | 2 | 3 |
| 6. Becoming easily annoyed or irritable | 0 | 1 | 2 | 3 |
| 7. Feeling afraid, as if something awful might happen | 0 | 1 | 2 | 3 |

Column totals _____ + _____ + _____ + _____ =

*Total score* _____

If you checked any problems, how difficult have they made it for you to do your work, take care of things at home, or get along with other people?

| Not difficult at all | Somewhat difficult | Very difficult | Extremely difficult |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |



## Scoring GAD-7 Anxiety Severity

This is calculated by assigning scores of 0, 1, 2, and 3 to the response categories, respectively, of "not at all," "several days," "more than half the days," and "nearly every day."
GAD-7 total score for the seven items ranges from 0 to 21.

0–4: minimal anxiety

5–9: mild anxiety

10–14: moderate anxiety

15–21: severe anxiety

Cognitive Flexibility Inventory

# Cognitive Flexibility Inventory (CFI)

## Instructions:

Please use the scale below to indicate the extent to which you agree or disagree with the following statements.

| | | Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|---|
| 1 | I am good at "sizing up" situations | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2 | I have a hard time making decisions when faced with difficult situations | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 3 | I consider multiple options before making a decision | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4 | When I encounter difficult situations, I feel like I am losing control | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 5 | I like to look at difficult situations from many different angles | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6 | I seek additional information not immediately available before attributing causes to behaviour | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7 | When encountering difficult situations, I become so stressed that I can not think of a way to resolve the situation | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 8 | I try to think about things from another person's point of view | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9 | I find it troublesome that there are so many different ways to deal with difficult situations | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 10 | I am good at putting myself in others' shoes | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 11 | When I encounter difficult situations, I just don't know what to do | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 12 | It is important to look at difficult situations from many angles | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 13 | When in difficult situations, I consider multiple options before deciding how to behave | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 14 | I often look at a situation from different view-points | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 15 | I am capable of overcoming the difficulties in life that I face | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 16 | I consider all the available facts and information when attributing causes to behaviour | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 17 | I feel I have no power to change things in difficult situations | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

| | | Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|---|
| 18 | When I encounter difficult situations, I stop and try to think of several ways to resolve it | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 19 | I can think of more than one way to resolve a difficult situation I'm confronted with | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 20 | I consider multiple options before responding to difficult situations | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

## Developer Reference:

Dennis, J. P., & Vander Wal, J. S. (2010). The cognitive flexibility inventory: Instrument development and estimates of reliability and validity. Cognitive Therapy and Research, 34(3), 241–253. https://doi.org/10.1007/s10608-009-9276-4

## Internet Gaming Disorder Scale – Short-Form[3]

**Internet Gaming Disorder Scale–Short-Form (IGDS9-SF) (Pontes & Griffiths, 2015)**

**Instructions:** These questions will ask you about your gaming activity during the past year (i.e., last 12 months). By gaming activity we understand any gaming-related activity that has been played either from a computer/laptop or from a gaming console or any other kind of device (e.g., mobile phone, tablet, etc.) both online and/or offline.

| | Never | Rarely | Sometimes | Often | Very Often |
|---|---|---|---|---|---|
| 1. Do you feel preoccupied with your gaming behavior? (Some examples: Do you think about previous gaming activity or anticipate the next gaming session? Do you think gaming has become the dominant activity in your daily life?) | ○ | ○ | ○ | ○ | ○ |
| 2. Do you feel more irritability, anxiety or even sadness when you try to either reduce or stop your gaming activity? | ○ | ○ | ○ | ○ | ○ |
| 3. Do you feel the need to spend increasing amount of time engaged gaming in order to achieve satisfaction or pleasure? | ○ | ○ | ○ | ○ | ○ |
| 4. Do you systematically fail when trying to control or cease your gaming activity? | ○ | ○ | ○ | ○ | ○ |
| 5. Have you lost interests in previous hobbies and other entertainment activities as a result of your engagement with the game? | ○ | ○ | ○ | ○ | ○ |
| 6. Have you continued your gaming activity despite knowing it was causing problems between you and other people? | ○ | ○ | ○ | ○ | ○ |
| 7. Have you deceived any of your family members, therapists or others because the amount of your gaming activity? | ○ | ○ | ○ | ○ | ○ |
| 8. Do you play in order to temporarily escape or relieve a negative mood (e.g., helplessness, guilt, anxiety)? | ○ | ○ | ○ | ○ | ○ |
| 9. Have you jeopardized or lost an important relationship, job or an educational or career opportunity because of your gaming activity? | ○ | ○ | ○ | ○ | ○ |

[3] Please note that the amended IGDSF-9 used in this research project is part of the information sheet and can be found in Appendix 3.

## Appendix 6 – Debrief sheet

### Research Participant Debrief Form for:

*Video games, mental health, and cognitive flexibility: an exploratory study*

Thank you for taking the time to take part in this research project.

**Research Aims**

The research project had two aims.

1. To contribute to our understanding of the impact, either positive or negative, on mental health of video games.
2. To determine if increased video game usage increases cognitive flexibility.
3. To understand if there are differences between different genres of video games and mental health/cognitive flexibility.

**More Information**

If you would like to find out more about this research, place contact.

Robert McGrath
Trainee Clinical Psychologist,
Department of Clinical Psychology,
School of Health, Science and Wellbeing, Staffordshire University,
Leek Road Campus,
32 Leek Road,
Stoke-on-Trent,
ST4 2RU.
Mw002215@student.staffs.ac.uk

**Withdrawing information**

You are free to withdraw your data from the study up until it is processed and anonymised (28 days after participation), after which point the withdrawal of your data will no longer be possible.

If you choose to withdraw from the study prior to this time, we will not retain any information that you have provided us as a part of this study. To do this, please email mw002215@student.staffs.ac.uk and quote your unique reference given to you.

**Further support**

If you have any questions about the research project please contact Robert McGrath on the details provided above. If you feel you need to speak with someone for support, you may wish to use the following services:

1. Mind UK www.mind.org.uk (0300 123 3393)
2. Samaritans www.samaritans.org (116 123 (free phone))

If you feel you are in a crisis, please call the emergency services on 999.

If you are worried about the amount of time you spending gaming and would like some support in reducing this, please visit The National Centre for Gaming Disorders website (https://www.cnwl.nhs.uk/national-centre-gaming-disorders) where you can find specific support.

**Complaints**

If you feel this study has caused you harm in any way or if you wish to make a complaint about the conduct of the study, you can contact the study supervisor or the Chair of the Staffordshire University Ethics Committee for further advice and information:

Dr. Nachi Chockalingham,
Director of Research,
Research, Innovation, and Impact Services,
Staffordshire University,
Leek Road Campus,
32 Leek Road,

Stoke-on-Trent,

ST4 2RU.

N.Chockalingham@staffs.ac.uk

Thank you once again for your participation in this research project.

**Appendix 7 – SPSS analysis output: Multiple regression for one predictor and two covariates on depression symptoms using a complete case approach (N = 163) including the bootstrapped output.**

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|---|---|---|---|---|---|
| 1 | .184[a] | .034 | .016 | 5.64683 | 2.083 |

a. Predictors: (Constant), How many hours on average, per week, do you play video games?, Which option best describes your gender? - Selected Choice, What is your age?

b. Dependent Variable: PHQ9score

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 177.129 | 3 | 59.043 | 1.852 | .140[b] |
| | Residual | 5069.975 | 159 | 31.887 | | |
| | Total | 5247.104 | 162 | | | |

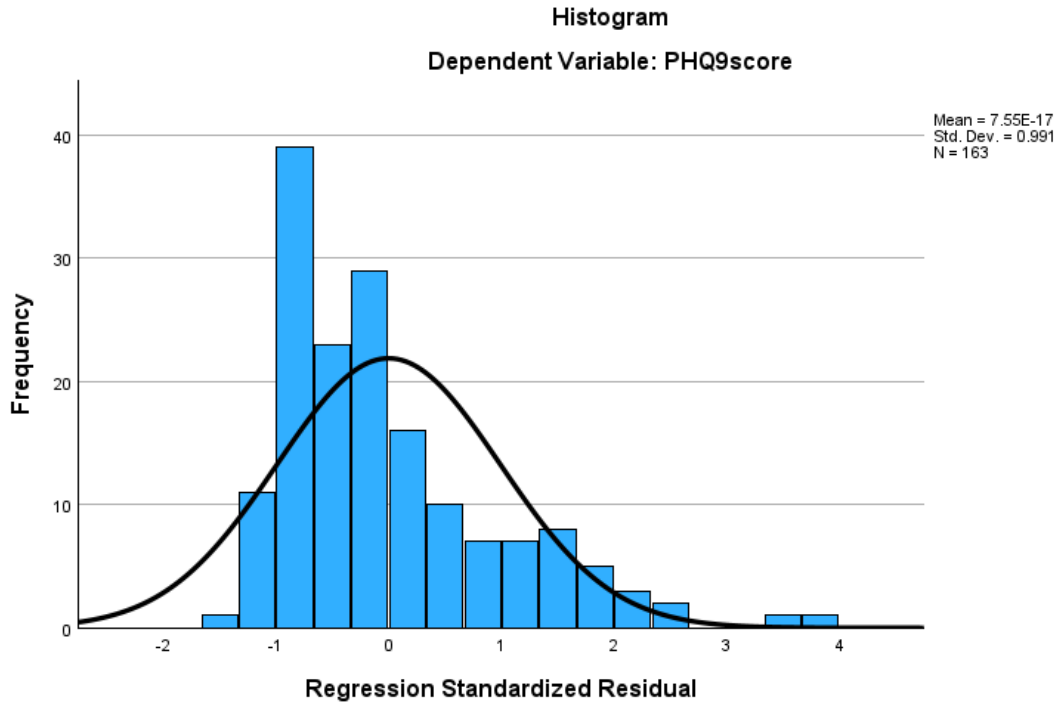
a. Dependent Variable: PHQ9score

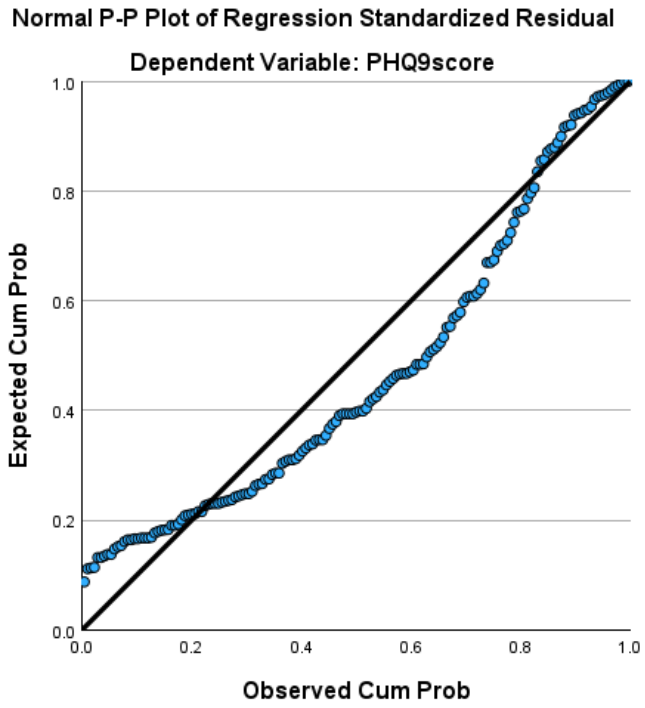
b. Predictors: (Constant), How many hours on average, per week, do you play video games?, Which option best describes your gender? - Selected Choice, What is your age?

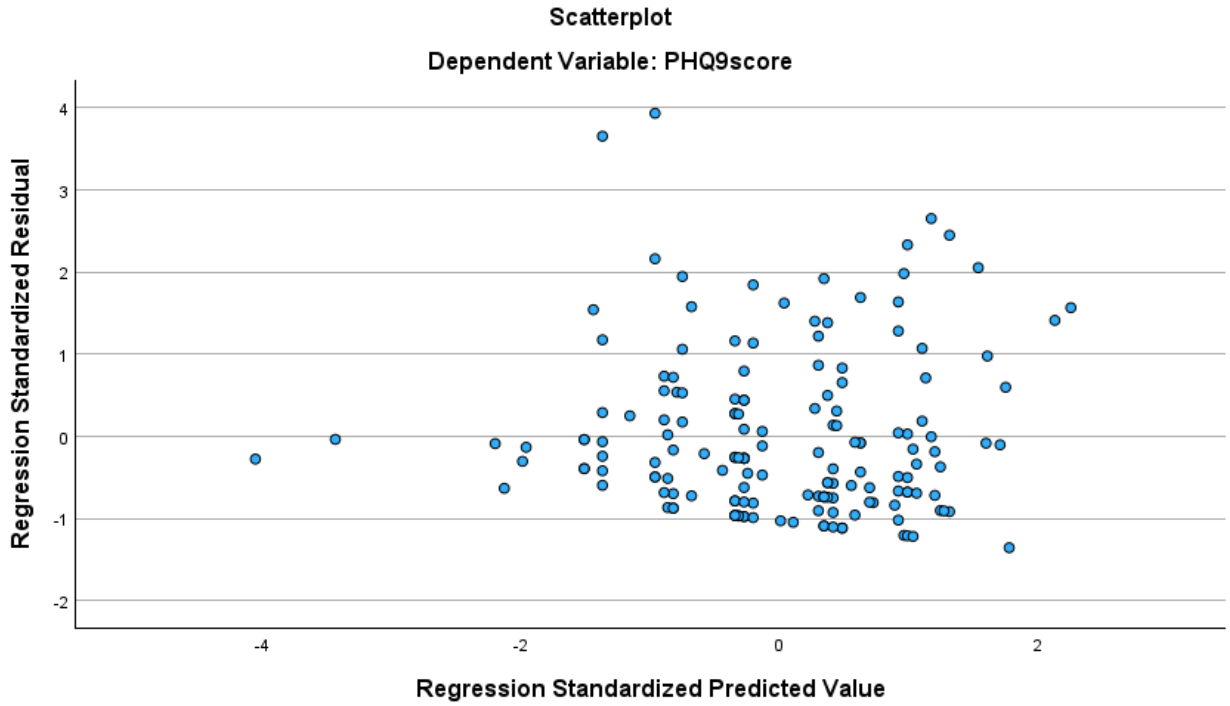
**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | | 95.0% Confidence Interval for B | | Correlations | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. | Lower Bound | Upper Bound | Zero-order | Partial | Part | Tolerance | VIF |
| 1 | (Constant) | 6.638 | 1.856 | | 3.576 | <.001 | 2.972 | 10.304 | | | | | |
| | What is your age? | -.646 | .319 | -.161 | -2.029 | .044 | -1.276 | -.017 | -.171 | -.159 | -.158 | .967 | 1.034 |
| | Which option best describes your gender? - Selected Choice | .675 | .844 | .063 | .800 | .425 | -.992 | 2.343 | .080 | .063 | .062 | .986 | 1.014 |
| | How many hours on average, per week, do you play video games? | .074 | .229 | .025 | .323 | .747 | -.378 | .526 | .046 | .026 | .025 | .978 | 1.022 |

a. Dependent Variable: PHQ9score


Histogram
Dependent Variable: PHQ9score
Mean = 7.55E-17
Std. Dev. = 0.991
N = 163
Frequency
Regression Standardized Residual


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: PHQ9score
Expected Cum Prob
Observed Cum Prob




**Bootstrap for Coefficients**

| Model | | B | Bootstrap[a] Bias | Std. Error | Sig. (2-tailed) | 95% Confidence Interval Lower | Upper |
|---|---|---|---|---|---|---|---|
| 1 | (Constant) | 6.638 | .092 | 1.823 | <.001 | 3.062 | 10.460 |
| | What is your age? | -.646 | .001 | .316 | .045 | -1.215 | .052 |
| | Which option best describes your gender? - Selected Choice | .675 | -.038 | .863 | .411 | -1.166 | 2.359 |
| | How many hours on average, per week, do you play video games? | .074 | -.011 | .241 | .763 | -.391 | .547 |

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

**Appendix 8 – SPSS analysis output: Multiple regression for one predictor and two covariates on anxiety symptoms using a complete case approach (N = 163) including the bootstrapped output.**

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|---|---|---|---|---|---|
| 1 | .271[a] | .073 | .056 | 4.84418 | 2.167 |

a. Predictors: (Constant), How many hours on average, per week, do you play video games?, Which option best describes your gender? - Selected Choice, What is your age?

b. Dependent Variable: GAD7score

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 295.935 | 3 | 98.645 | 4.204 | .007[b] |
| | Residual | 3731.108 | 159 | 23.466 | | |
| | Total | 4027.043 | 162 | | | |

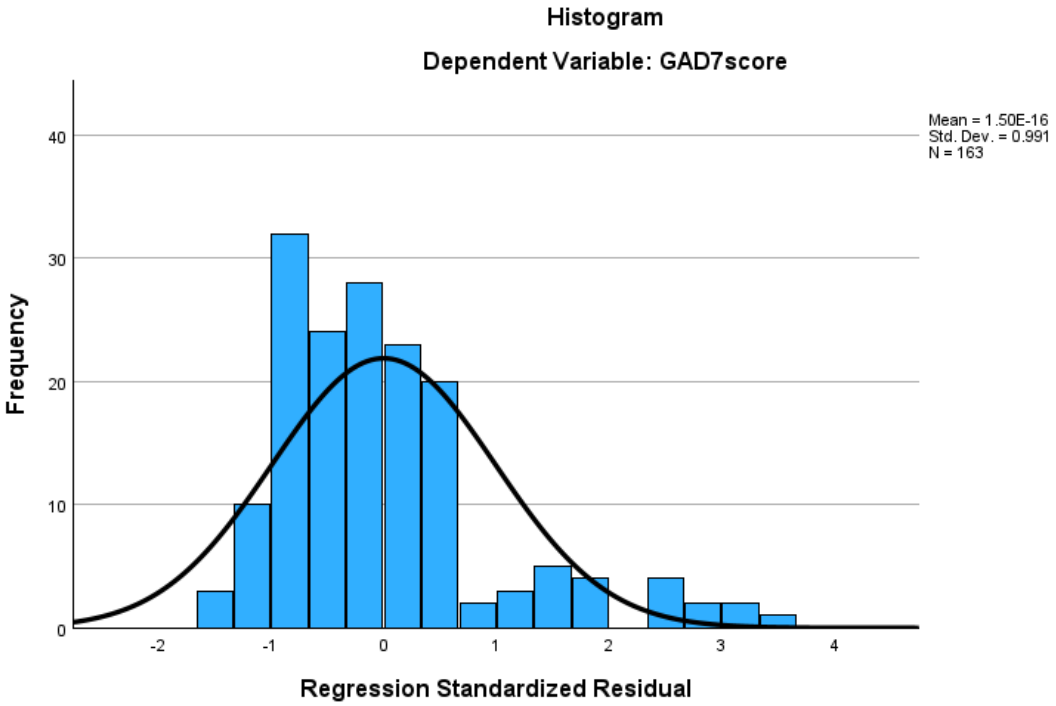
a. Dependent Variable: GAD7score

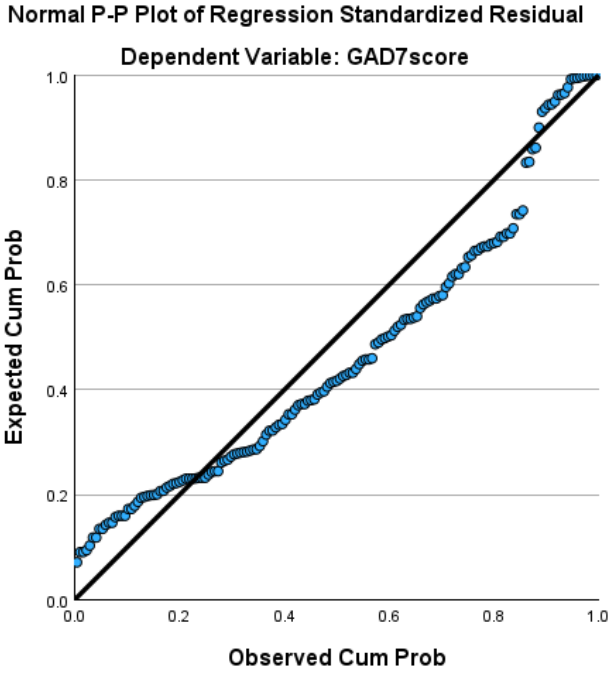
b. Predictors: (Constant), How many hours on average, per week, do you play video games?, Which option best describes your gender? - Selected Choice, What is your age?

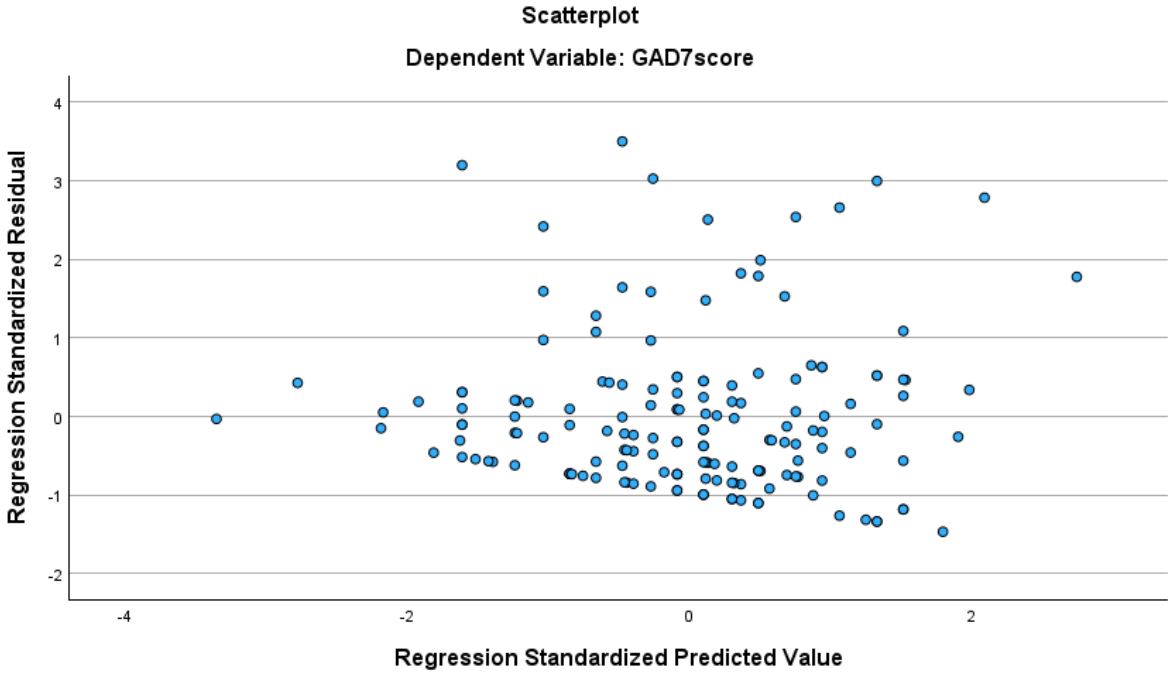
**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | | 95.0% Confidence Interval for B | | Correlations | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. | Lower Bound | Upper Bound | Zero-order | Partial | Part | Tolerance | VIF |
| 1 | (Constant) | 6.275 | 1.592 | | 3.941 | <.001 | 3.130 | 9.420 | | | | | |
| | What is your age? | -.777 | .273 | -.221 | -2.844 | .005 | -1.317 | -.237 | -.220 | -.220 | -.217 | .967 | 1.034 |
| | Which option best describes your gender? - Selected Choice | 1.136 | .724 | .121 | 1.569 | .119 | -.294 | 2.567 | .148 | .123 | .120 | .986 | 1.014 |
| | How many hours on average, per week, do you play video games? | -.252 | .196 | -.099 | -1.284 | .201 | -.640 | .136 | -.071 | -.101 | -.098 | .978 | 1.022 |

a. Dependent Variable: GAD7score


Histogram
Dependent Variable: GAD7score
Mean = 1.50E-16
Std. Dev. = 0.991
N = 163
Frequency
Regression Standardized Residual


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: GAD7score
Expected Cum Prob
Observed Cum Prob




**Bootstrap for Coefficients**

| Model | | B | Bootstrap[a] Bias | Std. Error | Sig. (2-tailed) | 95% Confidence Interval Lower | Upper |
|---|---|---|---|---|---|---|---|
| 1 | (Constant) | 6.275 | -.013 | 1.508 | <.001 | 3.472 | 9.480 |
| | What is your age? | -.777 | -.005 | .259 | .005 | -1.295 | -.320 |
| | Which option best describes your gender? - Selected Choice | 1.136 | -.023 | .719 | .126 | -.273 | 2.549 |
| | How many hours on average, per week, do you play video games? | -.252 | .009 | .199 | .200 | -.631 | .153 |

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

**Appendix 9 – SPSS analysis output: Multiple regression for one predictor and two covariates on cognitive flexibility using a complete case approach (N = 163) including the bootstrapped output.**

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|---|---|---|---|---|---|
| 1 | .256[a] | .065 | .048 | 15.96779 | 1.868 |

a. Predictors: (Constant), How many hours on average, per week, do you play video games?, Which option best describes your gender? - Selected Choice, What is your age?

b. Dependent Variable: CFItotal

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 2839.557 | 3 | 946.519 | 3.712 | .013[b] |
| | Residual | 40540.296 | 159 | 254.970 | | |
| | Total | 43379.853 | 162 | | | |

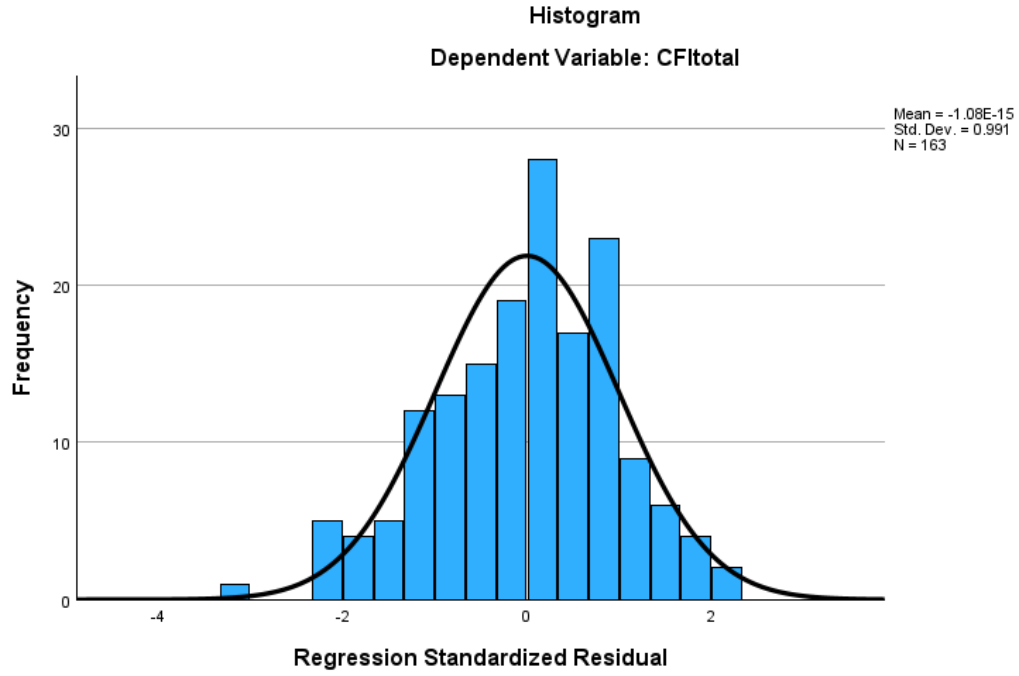
a. Dependent Variable: CFItotal

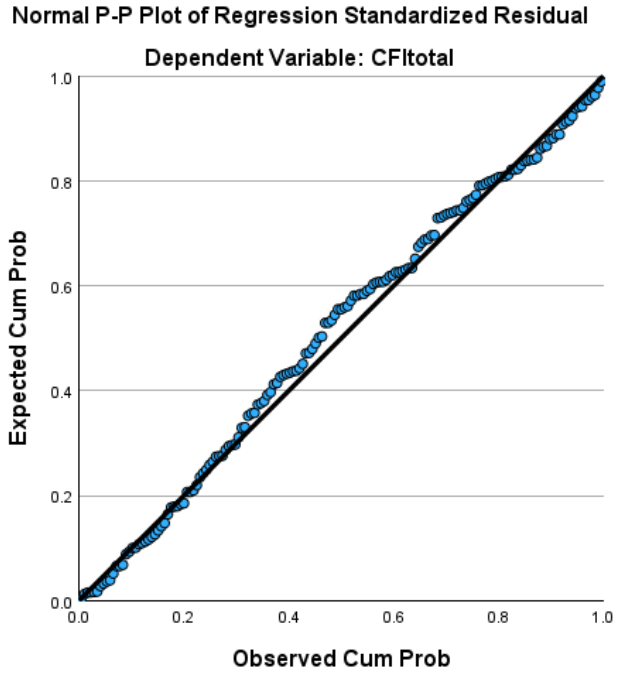
b. Predictors: (Constant), How many hours on average, per week, do you play video games?, Which option best describes your gender? - Selected Choice, What is your age?

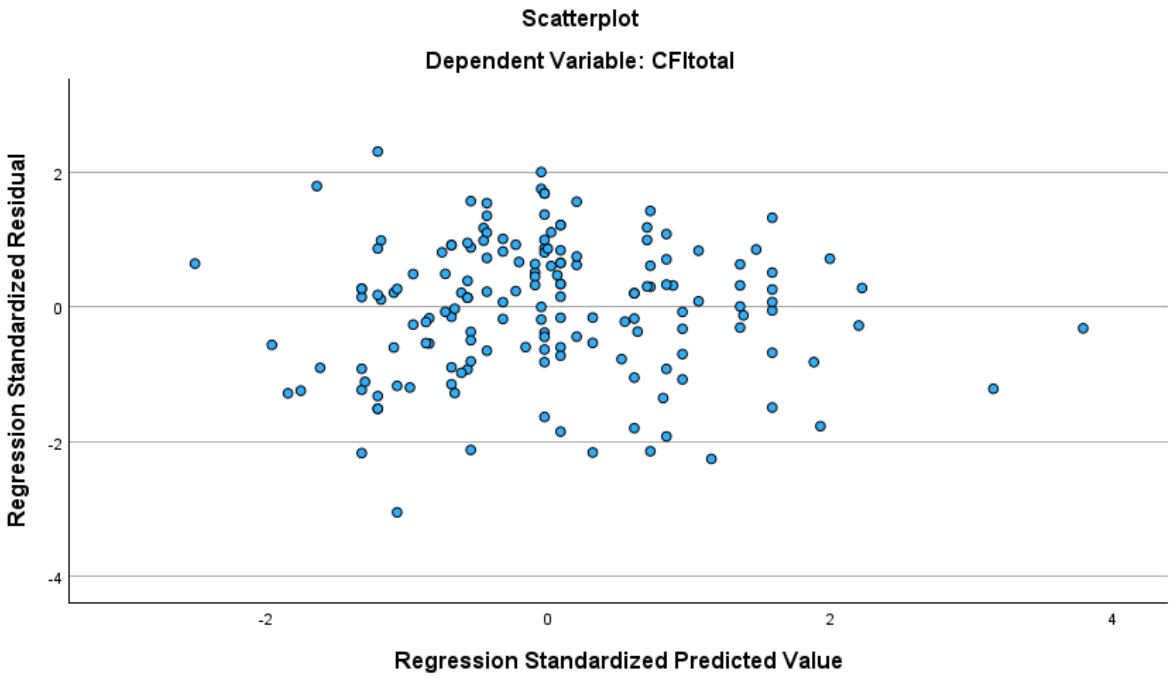
**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | | 95.0% Confidence Interval for B | | Correlations | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. | Lower Bound | Upper Bound | Zero-order | Partial | Part | Tolerance | VIF |
| 1 | (Constant) | 102.356 | 5.249 | | 19.501 | <.001 | 91.990 | 112.723 | | | | | |
| | What is your age? | 2.663 | .901 | .230 | 2.955 | .004 | .884 | 4.443 | .232 | .228 | .227 | .967 | 1.034 |
| | Which option best describes your gender? - Selected Choice | -2.760 | 2.388 | -.089 | -1.156 | .249 | -7.476 | 1.956 | -.116 | -.091 | -.089 | .986 | 1.014 |
| | How many hours on average, per week, do you play video games? | .477 | .647 | .057 | .736 | .463 | -.802 | 1.755 | .027 | .058 | .056 | .978 | 1.022 |

a. Dependent Variable: CFItotal


Histogram
Dependent Variable: CFItotal
Mean = -1.08E-15
Std. Dev. = 0.991
N = 163
Frequency
30
20
10
0
-4
-2
0
2
Regression Standardized Residual


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: CFItotal
Expected Cum Prob
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0
Observed Cum Prob




**Bootstrap for Coefficients**

| Model | | B | Bootstrap[a] Bias | Std. Error | Sig. (2-tailed) | 95% Confidence Interval Lower | Upper |
|---|---|---|---|---|---|---|---|
| 1 | (Constant) | 102.356 | .203 | 5.467 | <.001 | 91.510 | 113.684 |
| | What is your age? | 2.663 | .044 | .877 | .004 | 1.087 | 4.473 |
| | Which option best describes your gender? - Selected Choice | -2.760 | -.173 | 2.490 | .265 | -7.947 | 1.633 |
| | How many hours on average, per week, do you play video games? | .477 | -.025 | .587 | .446 | -.788 | 1.492 |

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

## Appendix 10 – SPSS analysis output: ANOVA exploring impact of genre of games on depression symptoms

**Tests of Homogeneity of Variances**

| | | Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|---|---|
| PHQ9score | Based on Mean | 1.350 | 3 | 159 | .260 |
| | Based on Median | .832 | 3 | 159 | .478 |
| | Based on Median and with adjusted df | .832 | 3 | 152.767 | .478 |
| | Based on trimmed mean | 1.184 | 3 | 159 | .318 |

**ANOVA**

PHQ9score

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 176.515 | 3 | 58.838 | 1.845 | .141 |
| Within Groups | 5070.589 | 159 | 31.890 | | |
| Total | 5247.104 | 162 | | | |

**ANOVA Effect Sizes[a,b]**

| | | | 95% Confidence Interval | |
|---|---|---|---|---|
| | | Point Estimate | Lower | Upper |
| PHQ9score | Eta-squared | .034 | .000 | .089 |
| | Epsilon-squared | .015 | -.019 | .072 |
| | Omega-squared Fixed-effect | .015 | -.019 | .072 |
| | Omega-squared Random-effect | .005 | -.006 | .025 |

a. Eta-squared and Epsilon-squared are estimated based on the fixed-effect model.

b. Negative but less biased estimates are retained, not rounded to zero.

**Robust Tests of Equality of Means**

PHQ9score

| | Statistic[a] | df1 | df2 | Sig. |
|---|---|---|---|---|
| Welch | 2.463 | 3 | 73.552 | .069 |
| Brown-Forsythe | 2.032 | 3 | 143.032 | .112 |

a. Asymptotically F distributed.

*Appendix 11 – SPSS analysis output: ANOVA exploring impact of genre of games on anxiety symptoms*

**Tests of Homogeneity of Variances**

| | | Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|---|---|
| GAD7score | Based on Mean | 1.278 | 3 | 159 | .284 |
| | Based on Median | .664 | 3 | 159 | .575 |
| | Based on Median and with adjusted df | .664 | 3 | 146.809 | .576 |
| | Based on trimmed mean | 1.062 | 3 | 159 | .367 |

**ANOVA**

GAD7score

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 110.791 | 3 | 36.930 | 1.499 | .217 |
| Within Groups | 3916.252 | 159 | 24.631 | | |
| Total | 4027.043 | 162 | | | |

**ANOVA Effect Sizes[a,b]**

| | | | 95% Confidence Interval | |
|---|---|---|---|---|
| | | Point Estimate | Lower | Upper |
| GAD7score | Eta-squared | .028 | .000 | .079 |
| | Epsilon-squared | .009 | -.019 | .061 |
| | Omega-squared Fixed-effect | .009 | -.019 | .061 |
| | Omega-squared Random-effect | .003 | -.006 | .021 |

a. Eta-squared and Epsilon-squared are estimated based on the fixed-effect model.

b. Negative but less biased estimates are retained, not rounded to zero.

**Robust Tests of Equality of Means**

GAD7score

| | Statistic[a] | df1 | df2 | Sig. |
|---|---|---|---|---|
| Welch | 1.971 | 3 | 74.531 | .126 |
| Brown-Forsythe | 1.705 | 3 | 150.695 | .168 |

a. Asymptotically F distributed.

## Appendix 12 – SPSS analysis output: ANOVA exploring impact of genre of games on cognitive flexibility

**Tests of Homogeneity of Variances**

| | | Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|---|---|
| CFItotal | Based on Mean | 1.477 | 3 | 159 | .223 |
| | Based on Median | 1.247 | 3 | 159 | .295 |
| | Based on Median and with adjusted df | 1.247 | 3 | 156.313 | .295 |
| | Based on trimmed mean | 1.522 | 3 | 159 | .211 |

**ANOVA**

CFItotal

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 645.743 | 3 | 215.248 | .801 | .495 |
| Within Groups | 42734.110 | 159 | 268.768 | | |
| Total | 43379.853 | 162 | | | |

**ANOVA Effect Sizes[a,b]**

| | | | 95% Confidence Interval | |
|---|---|---|---|---|
| | | Point Estimate | Lower | Upper |
| CFItotal | Eta-squared | .015 | .000 | .054 |
| | Epsilon-squared | -.004 | -.019 | .036 |
| | Omega-squared Fixed-effect | -.004 | -.019 | .036 |
| | Omega-squared Random-effect | -.001 | -.006 | .012 |

a. Eta-squared and Epsilon-squared are estimated based on the fixed-effect model.

b. Negative but less biased estimates are retained, not rounded to zero.

**Robust Tests of Equality of Means**

CFItotal

| | Statistic[a] | df1 | df2 | Sig. |
|---|---|---|---|---|
| Welch | .752 | 3 | 66.785 | .525 |
| Brown-Forsythe | .764 | 3 | 112.595 | .517 |

a. Asymptotically F distributed.

## Appendix 13 – SPSS analysis output: ANOVA exploring impact of gender on depression symptoms

**Tests of Homogeneity of Variances**

| | | Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|---|---|
| PHQ9score | Based on Mean | .252 | 1 | 157 | .617 |
| | Based on Median | .167 | 1 | 157 | .683 |
| | Based on Median and with adjusted df | .167 | 1 | 155.482 | .683 |
| | Based on trimmed mean | .173 | 1 | 157 | .678 |

**ANOVA**

PHQ9score

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 3.390 | 1 | 3.390 | .107 | .744 |
| Within Groups | 4977.717 | 157 | 31.705 | | |
| Total | 4981.107 | 158 | | | |

**ANOVA Effect Sizes[a,b]**

| | | Point Estimate | 95% Confidence Interval Lower | 95% Confidence Interval Upper |
|---|---|---|---|---|
| PHQ9score | Eta-squared | .001 | .000 | .029 |
| | Epsilon-squared | -.006 | -.006 | .023 |
| | Omega-squared Fixed-effect | -.006 | -.006 | .023 |
| | Omega-squared Random-effect | -.006 | -.006 | .023 |

a. Eta-squared and Epsilon-squared are estimated based on the fixed-effect model.

b. Negative but less biased estimates are retained, not rounded to zero.

**Robust Tests of Equality of Means**

PHQ9score

| | Statistic[a] | df1 | df2 | Sig. |
|---|---|---|---|---|
| Welch | .117 | 1 | 106.270 | .733 |
| Brown-Forsythe | .117 | 1 | 106.270 | .733 |

a. Asymptotically F distributed.

## Appendix 14 – SPSS analysis output: ANOVA exploring impact of gender on anxiety symptoms

**Tests of Homogeneity of Variances**

| | | Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|---|---|
| GAD7score | Based on Mean | .057 | 1 | 157 | .812 |
| | Based on Median | .090 | 1 | 157 | .764 |
| | Based on Median and with adjusted df | .090 | 1 | 156.936 | .764 |
| | Based on trimmed mean | .086 | 1 | 157 | .770 |

**ANOVA**

GAD7score

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 37.296 | 1 | 37.296 | 1.550 | .215 |
| Within Groups | 3777.307 | 157 | 24.059 | | |
| Total | 3814.604 | 158 | | | |

**ANOVA Effect Sizes[a,b]**

| | | | 95% Confidence Interval | |
|---|---|---|---|---|
| | | Point Estimate | Lower | Upper |
| GAD7score | Eta-squared | .010 | .000 | .061 |
| | Epsilon-squared | .003 | -.006 | .055 |
| | Omega-squared Fixed-effect | .003 | -.006 | .054 |
| | Omega-squared Random-effect | .003 | -.006 | .054 |

a. Eta-squared and Epsilon-squared are estimated based on the fixed-effect model.

b. Negative but less biased estimates are retained, not rounded to zero.

**Robust Tests of Equality of Means**

GAD7score

| | Statistic[a] | df1 | df2 | Sig. |
|---|---|---|---|---|
| Welch | 1.505 | 1 | 91.826 | .223 |
| Brown-Forsythe | 1.505 | 1 | 91.826 | .223 |

a. Asymptotically F distributed.

## Appendix 15: SPSS analysis output: ANOVA exploring impact of gender on cognitive flexibility

**Tests of Homogeneity of Variances**

| | | Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|---|---|
| CFItotal | Based on Mean | .794 | 1 | 157 | .374 |
| | Based on Median | .773 | 1 | 157 | .381 |
| | Based on Median and with adjusted df | .773 | 1 | 156.900 | .381 |
| | Based on trimmed mean | .872 | 1 | 157 | .352 |

**ANOVA**

CFItotal

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 689.639 | 1 | 689.639 | 2.611 | .108 |
| Within Groups | 41475.317 | 157 | 264.174 | | |
| Total | 42164.956 | 158 | | | |

**ANOVA Effect Sizes[a,b]**

| | | Point Estimate | 95% Confidence Interval Lower | Upper |
|---|---|---|---|---|
| CFItotal | Eta-squared | .016 | .000 | .075 |
| | Epsilon-squared | .010 | -.006 | .069 |
| | Omega-squared Fixed-effect | .010 | -.006 | .068 |
| | Omega-squared Random-effect | .010 | -.006 | .068 |

a. Eta-squared and Epsilon-squared are estimated based on the fixed-effect model.

b. Negative but less biased estimates are retained, not rounded to zero.

**Robust Tests of Equality of Means**

CFItotal

| | Statistic[a] | df1 | df2 | Sig. |
|---|---|---|---|---|
| Welch | 2.417 | 1 | 86.904 | .124 |
| Brown-Forsythe | 2.417 | 1 | 86.904 | .124 |

a. Asymptotically F distributed.

**Appendix 16: SPSS analysis output: Ordinal regression for one predictor and two covariates on depression symptoms using clinical cut-off scores (note: some cases have been combined for analysis purposes)**

**Case Processing Summary**

| | | N | Marginal Percentage |
|---|---|---|---|
| PHQ-9 ordianl | None | 91 | 55.8% |
| | Mild | 38 | 23.3% |
| | Moderate | 18 | 11.0% |
| | Moderately severe/Severe | 16 | 9.8% |
| Valid | | 163 | 100.0% |
| Missing | | 0 | |
| Total | | 163 | |

**Model Fitting Information**

| Model | -2 Log Likelihood | Chi-Square | df | Sig. |
|---|---|---|---|---|
| Intercept Only | 240.065 | | | |
| Final | 231.470 | 8.595 | 3 | .035 |

Link function: Logit.

**Goodness-of-Fit**

| | Chi-Square | df | Sig. |
|---|---|---|---|
| Pearson | 169.103 | 177 | .652 |
| Deviance | 157.541 | 177 | .851 |

Link function: Logit.

**Pseudo R-Square**

| | |
|---|---|
| Cox and Snell | .051 |
| Nagelkerke | .057 |
| McFadden | .023 |

Link function: Logit.

**Parameter Estimates**

| | | Estimate | Std. Error | Wald | df | Sig. | 95% Confidence Interval Lower Bound | 95% Confidence Interval Upper Bound |
|---|---|---|---|---|---|---|---|---|
| Threshold | [PHQ9ordinal = 1.00] | -.066 | .652 | .010 | 1 | .920 | -1.343 | 1.211 |
| | [PHQ9ordinal = 2.00] | 1.075 | .659 | 2.657 | 1 | .103 | -.217 | 2.367 |
| | [PHQ9ordinal = 3.00] | 1.985 | .683 | 8.438 | 1 | .004 | .646 | 3.325 |
| Location | Age | -.291 | .120 | 5.851 | 1 | .016 | -.527 | -.055 |
| | Gender | .311 | .284 | 1.202 | 1 | .273 | -.245 | .867 |
| | Hours_per_week_OR | .051 | .084 | .371 | 1 | .542 | -.114 | .217 |

Link function: Logit.

**Appendix 17: SPSS analysis output: Ordinal regression for one predictor and two covariates on anxiety symptoms using clinical cut-off scores (note: some cases have been combined for analysis purposes)**

**Case Processing Summary**

| | | N | Marginal Percentage |
|---|---|---|---|
| GAD7 rating | None | 101 | 62.0% |
| | Mild | 42 | 25.8% |
| | Moderate | 9 | 5.5% |
| | Severe | 11 | 6.7% |
| Valid | | 163 | 100.0% |
| Missing | | 0 | |
| Total | | 163 | |

**Model Fitting Information**

| Model | -2 Log Likelihood | Chi-Square | df | Sig. |
|---|---|---|---|---|
| Intercept Only | 200.516 | | | |
| Final | 181.365 | 19.152 | 3 | <.001 |

Link function: Logit.

**Goodness-of-Fit**

| | Chi-Square | df | Sig. |
|---|---|---|---|
| Pearson | 128.244 | 177 | .998 |
| Deviance | 113.580 | 177 | 1.000 |

Link function: Logit.

**Pseudo R-Square**

| | |
|---|---|
| Cox and Snell | .111 |
| Nagelkerke | .129 |
| McFadden | .059 |

Link function: Logit.

**Parameter Estimates**

| | | Estimate | Std. Error | Wald | df | Sig. | 95% Confidence Interval Lower Bound | 95% Confidence Interval Upper Bound |
|---|---|---|---|---|---|---|---|---|
| Threshold | [GAD7rating = 1.00] | -1.026 | .726 | 1.994 | 1 | .158 | -2.449 | .398 |
| | [GAD7rating = 2.00] | .563 | .733 | .590 | 1 | .442 | -.874 | 2.001 |
| | [GAD7rating = 3.00] | 1.243 | .758 | 2.689 | 1 | .101 | -.243 | 2.729 |
| Location | Age | -.543 | .146 | 13.783 | 1 | <.001 | -.830 | -.256 |
| | Gender | .330 | .301 | 1.207 | 1 | .272 | -.259 | .919 |
| | Hours_per_week_OR | -.140 | .095 | 2.181 | 1 | .140 | -.325 | .046 |

Link function: Logit.

## Appendix 18: Author guidelines

Please refer to the Computers in Human Behavior webpage for the author guidelines: https://www.sciencedirect.com/journal/computers-in-human-behavior/publish/guide-for-authors

- APA 7th referencing has been used in the current paper as per journal guidelines.
- No specific word limit is set.
- Between 1 – 7 keywords will be generated to make the study discoverable prior to submission to the journal.

# Paper 3: Executive Summary

## Do increased hours of video-gaming predict differences in depression, anxiety, and cognitive flexibility?

Word count: 2416/2500 (Excluding title page and references)

## Summary

This report summarises a research project exploring the relationship between increased frequency of video-gaming and in adults in the UK, and how this relates to depression and anxiety symptoms, and their cognitive flexibility. The project also looked at the any differences depending on the genre of videogame being played, as well as any differences between genders.

This research was conducted as there is a lack of research into how video-gaming affects adults. There is a lot of research into how video-gaming affects adolescents, as well as how it affects people if they play videogames too much, which is classed as 'problematic gaming'. However, research specifically on adults who play videogames as a hobby is lacking, despite it becoming a more common hobby for adults.

This summary was written for video-gamers, as well as anyone interested in this research area. It was developed with the support of three adults who play video-games, who kindly reviewed the report to provide feedback on its wording, layout, structure, and general readability.

## Background

### Mental Health Difficulties

Mental health difficulties are common, with around one in six people in the UK reporting a common mental problem (e.g., depression or anxiety) in any given week (Baker & Kirk-Wade, 2023). Additionally, there was a rise in common mental health difficulties during the COVID-19 pandemic lockdowns (O'Connor et al., 2021). It is therefore important that people with these difficulties have ways to cope, including hobbies.

### Video-gaming

Video-gaming is a common hobby, with some figures suggesting that worldwide, over 1.7 billion people play them (Jovanovic, 2022). The number of people who play videogames is increasing (Clement, 2021), and during the COVID-19 pandemic there was an increase in videogame usage (Barr & Copeland-Stewart, 2021). There is conflicting research on how playing videogames can impact people. Some studies have found that it can increase depression and anxiety symptoms (Wei et al., 2012), whereas others have found that it can reduce them (Li et al., 2016; Pallavicini et al., 2021).

The majority of research that has been carried out that has explored videogames has focused on either adolescents (Janssen, 2016), or people who fall into the 'problematic gaming' category (Mannikko et al., 2020). This is essentially when a person is addicted to playing videogames, which can impact their ability to carry out other important daily tasks. It is now recognised as a formal diagnosis. However, research exploring those who do not fall into the 'problematic gaming' category is limited.

Additionally, it is not clear how the genre of videogame being played may affect people, or if there are any gender differences. Some genres of videogames, such as Massively Multiplayer Online Role-Playing Games (MMORPG), can predispose people to 'problematic gaming' (Elliot et al., 2012). Other genres, such as action games using Microsoft Xbox Kinect or Nintendo Wii, have been found to improve depression symptoms (Cancer et al., 2020). However, most genres have not been explored in any real depth. In relation to the gender of the videogame player, research has shown that videogames are no longer a hobby just for males, as more females are playing videogames than ever before (Lopez-Fernandez et al., 2019). Despite this, research into any gender differences is lacking. Initial research has found a difference in genders in relation to their motivation to play videogames (Vetri et al., 2014), and in adolescents, females gamers have been found to have more mental health difficulties when they play videogames more frequently (Twenge & Farley, 2021).

Finally, most of the research exploring those who play videogames has focused on either playing videogames or not playing videogames, but no known research has looked at adults who spend more time playing videogames compared to adults who spend less time playing them. Some research has shown that increased time looking at screens is linked to higher depression and anxiety symptoms (Cao et al., 2011; Maras et al., 2015), but research into specifically increased time playing videogames is lacking.

## Cognitive Flexibility

Cognitive flexibility is the ability to match the type of thinking with the type of problem at hand (Laureiro-Martinez & Brusoni, 2018). It allows people to think adaptively during stressful situations and can help them from getting stuck in unhelpful thinking patterns (Dennis & Vander Wal, 2010). As one part of cognitive flexibility is problem solving, which is key to many videogames (Adachi & Wolloughby, 2013), it is worth exploring how increased hours of video-gaming may change cognitive flexibility. A recent review of the research has found that engaging in any video-gaming can improve performance on some tasks (Reynaldo et al., 2021).

### Why carry out this study?

As playing videogames is becoming more common, especially in adults, there is a growing need to understand how more frequent video-gaming may predict depression and anxiety symptoms, as well as people's cognitive flexibility. Exploring these factors, as well as any group differences between genre of game and gender of the player, may aid in understanding whether more frequent video-gaming is positive or not.

### Aims of the study

This study aimed to investigate if increased frequency of video-gaming predicted lower depression and anxiety symptoms, and increased cognitive flexibility. It also explored whether increased frequency of video-gaming affected genders differently, and whether there were any differences depending on the genre of videogame played.

## Methods

This study was approved by the Staffordshire University ethics committee.

### How were participants recruited?

Participants were recruited in March 2024. An advertisement was shared via social media platforms (e.g. X, Discord, LinkedIn), and participants were encouraged to share the advertisement with others who might be suitable to participate.

### Who could take part?

Participants had to meet the following criteria to be suitable to participate:

| To take part, participants had to: | Participants could not take part if: |
|---|---|
| • Be 18 or over<br>• Be living in the UK<br>• Be fluent in English<br>• Play at least one hour of videogames per week | • They were classed as 'problematic gamers', as defined by a questionnaire that participants completed as part of the information sheet. |

## What did taking part involve?

This research used a cross-sectional design (which means data was collected at one point in time). The study advert included a URL link that took participants to a 15-minute online questionnaire. This involved an information section about the study. It also included a series of questions about 'problematic gaming', where participants were able to self-screen themselves. If they met the threshold for 'problematic gaming', they were told they could not proceed with the study. It they did not meet the threshold, they were then presented with a consent form to complete if they still wished to participate.

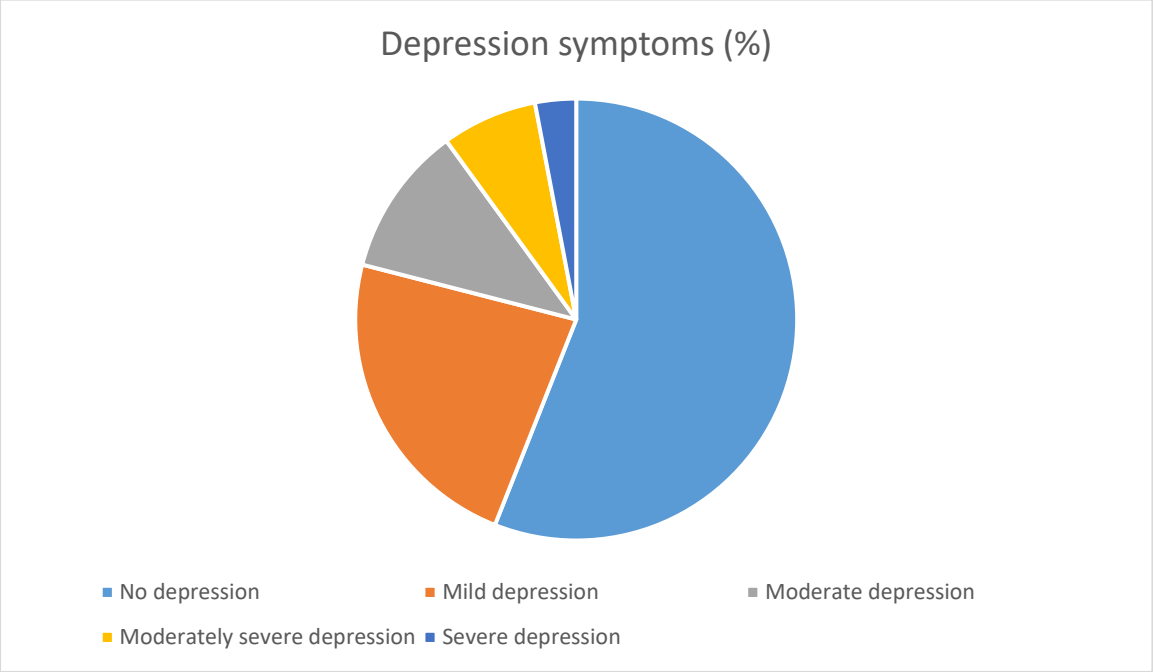
Participants were then asked their age, their self-identified gender, their ethnicity, how many hours of videogames they play a week, the genre of game they usually play, what platform they played videogames on, any history of mental health diagnoses, and any recent illicit substance misuse.

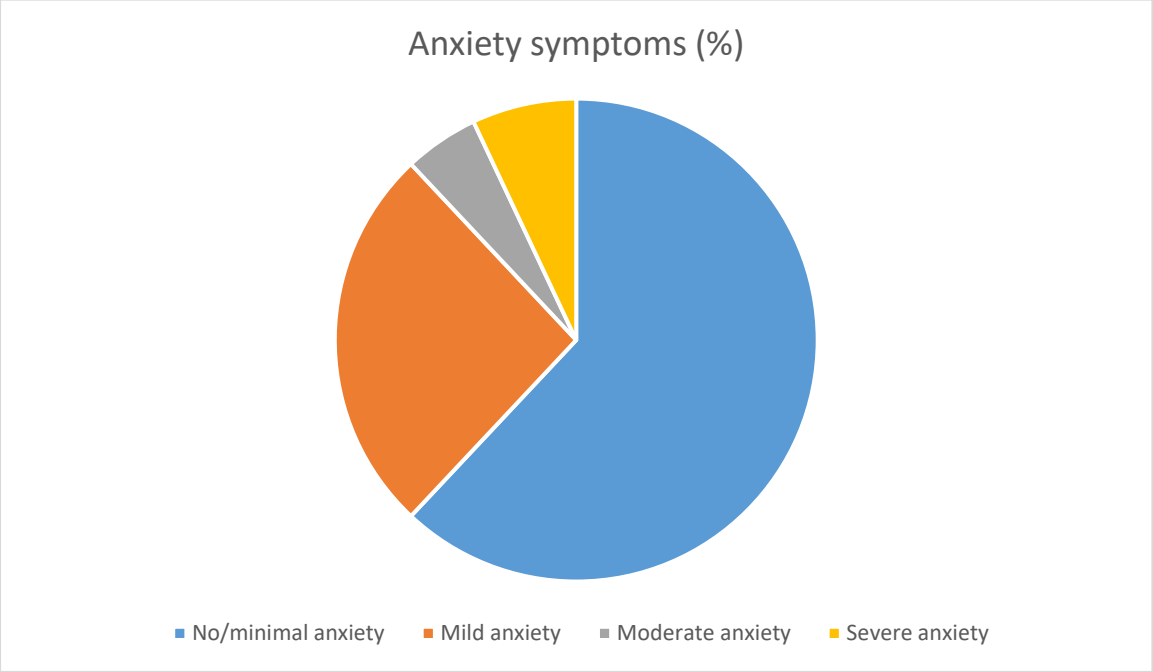
This was then followed by three questionnaires:

1. **The Patient Health Questionnaire – 9 (Kroenke et al., 2001)** is a nine-item questionnaire that measures depression symptoms that a person has experienced in the last two weeks.
2. **The Generalised Anxiety Disorder – 7 assessment (Spitzer et al., 2006)** is a seven-item questionnaire that measures anxiety symptoms that a person has experiences in the last two weeks.
3. **The Cognitive Flexibility Inventory (Dennis & Vander Wal, 2010)** is a 20-item questionnaire that measures cognitive flexibility. It is used to monitor how often individuals engage in ways to think adaptively when encountering stressful life events. It has two scales, measuring *alternative strategies (being able to come up with different ways to solve difficult situations)* and *cognitive strategies (the belief that the outcome of events are due to their own ability, and not down to luck)*.

## Who took part?

163 participants completed all the questionnaires. Most participants were White-British (72%) and most identified as male (67%). Most participants played role-playing games (34%) and played for 6 – 10 hours on average per week (28%). Most participants were aged between 25 – 34 (57%). There was a very even split on platform used to play videogames, with a slight majority playing on PC (51%) compared to console (49%).


Depression symptoms (%)
No depression
Mild depression
Moderate depression
Moderately severe depression
Severe depression

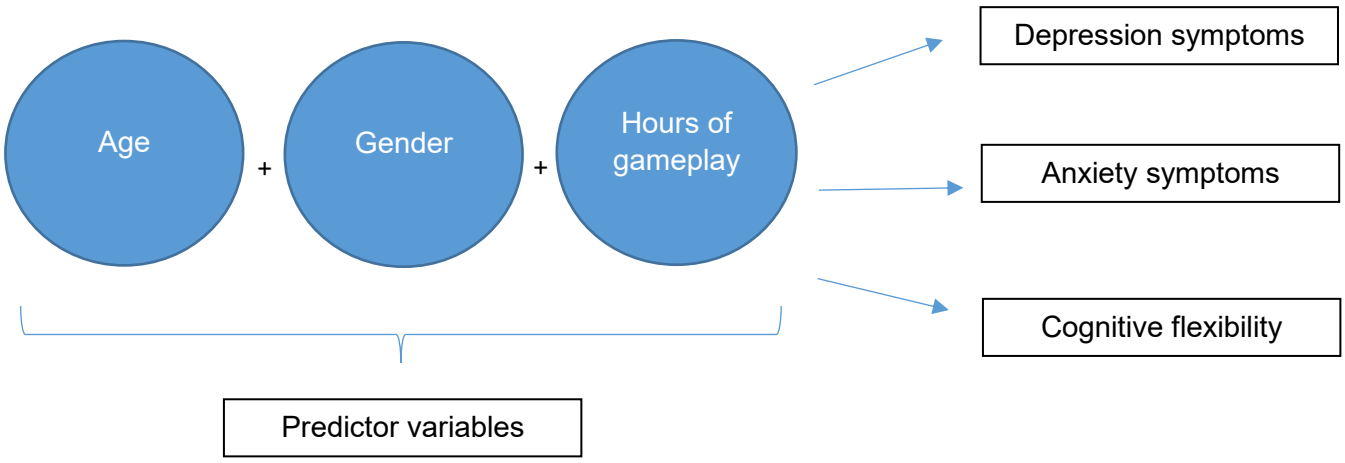

Anxiety symptoms (%)
No/minimal anxiety
Mild anxiety
Moderate anxiety
Severe anxiety

## How was the data analysed?

Multiple regression analysis was used to assess if increased hours of playing videogames predicted a decrease in depression and anxiety symptoms, as well as an increase in cognitive flexibility. Additionally, analysis of variance tests were used to understand if there were any differences between genre of game played on the above factors, as well as if there were any group differences between genders.

If the analysis finds that a factor has a high chance of predicting the rate of the other factors, then it is called a “significant predictor”.

Three multiple regression analyses were used in this study to predict depression symptoms, anxiety symptoms, and cognitive flexibility. These domains were predicted using the following factors: age, gender, and hours of video-gaming per week. The diagram below aims to explain this:




## Hypotheses

There were five different hypotheses made within this study:

1. Increased frequency of video-gaming would predict lower levels of depression symptoms.
2. Increased frequency of video-gaming would predict lower levels of anxiety symptoms.
3. Increased frequency of video-gaming would predict better cognitive flexibility.
4. There would be differences in depression symptoms, anxiety symptoms, and cognitive flexibility, depending on the genre of game played.

5. There would be differences in depression symptoms, anxiety symptoms, and cognitive flexibility, depending on the gender of the person playing.

## Key findings

### Hypothesis one: Increased frequency of video-gaming would predict lower levels of depression symptoms.

The results from this study showed that playing videogames more frequently did not predict lower levels of depression.

### Hypothesis two: Increased frequency of video-gaming would predict lower levels of anxiety symptoms.

The results from this study showed that playing videogames more frequently did not predict lower levels of anxiety.

### Hypothesis three: Increased frequency of video-gaming would predict better cognitive flexibility.

The results from this study showed that playing videogames more frequently did not predict better cognitive flexibility.

### Hypothesis four: There would be differences in depression symptoms, anxiety symptoms, and cognitive flexibility, depending on the genre of game played.

The results from this study showed that there were no differences between genre of videogame played. It should be noted that due to small numbers of players in some genres, these were combined into an 'other' category to help with analysis.

### Hypothesis five: There would be differences in depression symptoms, anxiety symptoms, and cognitive flexibility, depending on the gender of the person playing.

The results from this study showed there were no differences between genders.

## Practical applications

- This study did not find any significant results. However, it should be recognised that those who struggle with ‘problematic gaming’ are more likely to be depressed or anxious. For those with those diagnoses, it would be useful to screen them for ‘problematic gaming’ to understand if the amount of time they play videogames is making their symptoms worse.
- Additionally, there were no differences between genders in this study. This was surprising, as gender differences have been found in studies in adolescents that play videogames (Twenge & Farley, 2021). It is possible that these differences are no longer present, however further research is needed.

## Limitations

The research does have limitations:

- This study recruited more males than females, so it is unclear whether the results are generalisable to females or people who identify as non-binary.
- This study relied on online responses. It is therefore difficult to know if the responses were accurate, or whether participants accurately screened themselves out when asked about being a ‘problematic gamer’.
- There were some problems with the analysis, as the multiple regression models did not fit the data very well. The results should be taken with some caution.
- This study used a questionnaire to measure cognitive flexibility. Usually, this is measured with practical tasks. It might be that using the questionnaire actually measured participants’ view of their own cognitive flexibility, but did not give an objective view of participants’ cognitive flexibility.

## Recommendations for researchers

Due to the limitations mentioned, readers should take caution when interpreting the results. Future research is recommended to help verify the results, as well as build the knowledge base in adults who play videogames. Examples of future research include:

- Exploring whether the results would be the same in a group of video-gamers who are already depressed and/or anxious. It would be useful to understand whether increased video-gaming improves depression and/or anxiety in those who are

already diagnosed, as this study predominantly focuses on those without a diagnosis of depression and/or anxiety.

- Exploring how video-gaming affects specifically females and those who identify as non-binary/third genders. It is recognised that the current demographic of video-gamers is changing (Lopez-Fernandez et al., 2019), but this study presents findings from mainly males.
- Exploring depression symptoms, anxiety symptoms, and cognitive flexibility in video-gamers as they age. The results from this study found that as participants aged, their depression and anxiety symptoms reduced, and their cognitive flexibility increased. This was not a hypothesis in this study, but was a significant finding of the results. It is not possible to say that this is down to video-gaming, however future research into how videogames may help people as they age would be useful. This is especially important as this is the first generation of adults who have been able to play videogames, and they will soon reach 'older age'.
- Repeating this research with a larger sample size of participants. As some of the genres groups were combined, this study was not able to effectively compare all genres.

## Conclusion

This study found that increased hours of video-gaming did not improve depression symptoms, anxiety symptoms, or cognitive flexibility scores in adults in the UK. There were also no significant differences between genre of videogame played or gender of the video-gamer on depression symptoms, anxiety symptoms, or cognitive flexibility. The findings have helped to contribute to our knowledge of more frequent videogame-play in adulthood.

## Dissemination

This research will be shared with the Research and Development Team at Midlands Partnership NHS Trust. This research will also be submitted to a research journal called "Computers in Human Behavior" for publication.

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