

Correlates and Cognitive Mechanisms Associated with Internet Pornography Use



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DECLARATION

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Abstract

Since the advent of the Internet, pornography use has proliferated, covarying with increasing rates of Internet pornography (IP) addiction. However, IP addiction is a contentious concept because there are no definitive criteria for it and because it falls under the relatively unexplored category of behavioural additions. In this article, we review various domains of the related literature, such as estimated rates of IP use and problematic use, and evidence that IP use can become addictive including a neuroscientific perspective. We then consider the cognitive mechanisms that may be involved in IP addiction, before offering some directions for future research.

Literature Review: The Potential Role of Cognitive Mechanisms in Internet Pornography Use

The Internet enables anyone with an online connection to access pornography privately and inexpensively. In this manuscript, pornography will be defined, followed by the effect that the Internet has had on rates of pornography consumption, and the proposed reasons for this. Although Internet pornography (IP) purportedly has both positive and negative effects, one concern is the possibility of IP addiction. However, the concept of IP addiction is controversial, partly because it is a behavioural addiction, a construct that has only recently been acknowledged by the American Psychiatric Association (APA; 2013), and also because there are no definitive diagnostic criteria. Two models that incorporate IP addiction are considered and the evidence supporting IP addiction is discussed. Cognitive-behavioural models of general Internet addiction are explored and then applied to IP addiction. The increased understanding of the cognitive aspects of IP addiction will be important to inform potential treatments.

1.1 Defining Pornography

There is no consensus of what constitutes pornography in the research literature, with some researchers suggesting overlapping or even conflicting definitions, arguably attenuating the utility of the construct (Campbell & Kohut, 2017). Scholars have utilised a variety of methods to investigate this construct. These range from using the term pornography generically and asking participants about their use within a certain period of time (e.g., Carroll et al., 2008) to asking participants about pornography in the context of a specific medium (e.g., the Internet; Harper & Hodgins, 2016). Other scholars have provided participants with lists of sexual acts that elicit sexual thoughts or feelings as an operationalised definition of pornography (e.g., Kor et al., 2014). Willoughby and Busby (2016) found that definitions of pornography vary as a function of individual differences

(e.g., gender, religiosity) but these differences are relatively modest compared to the impact of the content of the material (e.g., sexual acts vs. sexualised posing). However, there is significantly more agreement on what constitutes hard-core pornography in comparison to softer-core content (Willoughby & Busby, 2016). Campbell and Kohut (2017) suggest that pornography is reliably considered to be defined by the representation of nudity and sexualised behaviours.

1.2 Prevalence of Pornography

Globally, there is a big appetite for pornography that the Internet fulfils. Ropelato (2006) reported that pornographic websites constituted 12% of all websites online and there were 68 million pornographic search requests a day (approximately 25% of all Internet searches). According to Pornhub (2019), one of the biggest providers of IP, in 2019 they had 42 billion visits to their site, an average of 115 million per day, with 39 billion searches performed, equating to roughly 18, 073 terabytes of data per day. Furthermore, recent estimates suggest that IP videos make up 27% of all Internet traffic, while in 2018 the greenhouse gases generated from electricity consumption of computers worldwide due to the streaming of IP produced the same amount of carbon emissions as all of France's households combined (The Shift Project, 2019).

Although the aforementioned lack of consensus for a definition of pornography and the taboo nature make approximating rates of use more challenging, several studies have provided estimates. Carroll et al. (2008) analysed data from a multisite study using US undergraduate and graduate students. They found that 87% of males used pornography at some level and 20% used daily or every other day, while 48.4% used at least once per week. Contrastingly, 31% of females reported pornography use at some level and of those using pornography the majority used once a month or less and only 3.2% used weekly or more. A nationally representative sample in the US found that approximately 46% of adult males and 16% of adult females were found to use IP on a weekly basis (Regnerus, Gordon, & Price,

2015). While a nationally representative sample from Australia found that 84% of males and 54% of females had ever watched pornographic material, with 76% of adult males and 41% of adult females having viewed pornographic material in the previous year (Rissel et al., 2017).

To investigate how the Internet has affected pornography consumption, Price, Patterson, Regnerus, and Walley (2015) used data over a 40-year period from the General Social Survey. They distinguished between age, cohort, and time period effects and found that pornography consumption had increased, but perhaps less than would be expected, with a 16% difference for males between the 1970s and 2000s (a 36% increase) and an 8% difference for females (a 29% increase) in the same timeframe.

Cooper (1998) proposed three factors that drive the increase in IP use, which he termed the Triple A Engine: Access, Affordability, Anonymity. Access refers to the ease and convenience of the Internet that enables one to find pornographic material, 24-hours-a-day from virtually anywhere with an Internet connection. The abundance of pornography on the Internet has led to it becoming highly affordable; once the expense of an Internet connection has been met, a user can access an almost limitless amount of IP at no extra cost. Finally, anonymity conduces an environment wherein a person can freely explore their sexuality. Included in the top 25 of Pornhub's (2019) most searched terms are teen, gangbang, and two well-known pornographic acronyms MILF and BBC, illustrating the powerful effect of anonymity according to the Triple A model.

1.3 Effects of IP Use

Concerns have been raised that IP use can result in a variety of harms. These harms include disinterest in sexual relations with their corporal partner (Poulsen, Busby, & Galovan, 2013), increased insecurity (Kohut, Fisher, & Campbell, 2016), adverse effects on self-esteem and emotional state, impaired sexual arousal and orgasm (Schneider, 2000), psychological distress (Egan & Parmar, 2013), and use of pornography in the workplace

(Cooper, Golden, & Kent-Ferraro, 2002). Furthermore, people who use pornography may develop negative perceptions about women and if the pornography has violent themes, users may be more likely to engage in sexual violence themselves (Fisher, Belfry, & Lashambe, 1999). The media also frequently claim that IP use causes erectile dysfunction (ED; Ley, Prause, & Finn, 2014; Park et al., 2016).

However, some of the claims that IP use is damaging appear to be influenced by various factors such as religious values (Leonhardt, Willoughby, & Young-Peterson, 2017), while others, such as ED, have equivocal evidence. Park et al. (2016) report that historically ED rates for men under 40-years-old was consistently 2% and generally regarded as an age-related problem. But since the widespread accessibility of IP streaming sites in the mid 2000s, ED in men under 40 has increased substantially to 14-28%, leading to suggestions that IP use is the cause (Park et al., 2016). However, other studies have found little to no correlation between IP use and ED (Landripet & Štulhofer, 2015). Grubbs and Gola (2018) used a cross sectional sample, a nationally representative sample, and a longitudinal sample to investigate the relationship between IP and ED and found no causal evidence of IP use on ED. Moreover, Prause and Pfaus (2015) found that viewing sexual stimuli was associated with increased sexual responsiveness rather than ED.

Positive effects have also been reported including IP providing the opportunity to explore sexuality with less physical and social risk compared to offline activities (Griffiths, 2012), and with the majority of IP users evaluating it positively, reporting improvements in their personal and sexual lives (Hald & Malamuth, 2008). IP users also report empowerment and validation of their sexual behaviours (Weinberg, Williams, Kleiner, & Irizarry, 2010). IP has also facilitated sexual exploration for a number of groups such as homosexual (McLelland, 2002) and transgendered people (Broad, 2002). Qualitative evidence suggests that couples who use pornography reported improved sexual communication, sexual comfort,

and more sexual experimentation (Kohut et al., 2016). More controversially, Fisher and Barak (2001) note that rates of forcible rape in the US between 1995 and 1999 diminished considerably during a time when IP availability was going through a phase of exponential growth, although the authors acknowledge this is open to a number of interpretations.

1.4 IP Addiction?

Nevertheless, there are legitimate concerns that the Triple A effect has the potential to facilitate problematic use of IP (Kor et al., 2014). However, gathering data on the prevalence of problematic IP use is difficult due to lack of consensus of what constitutes problematic use, the diverse tools researchers have used to measure it (Alarcon, de la Iglesia, Casado, & Montejo, 2019), and the reliance on convenience samples, precluding the generalisability of results. Nonetheless, some estimates include: Cooper, Delmonico, and Burg (2000) estimated that 17% of IP users have out of control or problematic use; a Swedish study with 1913 participants found that 18% of men and 7% of women self-reported problematic use of IP (Ross, Månsson, & Daneback, 2011); a Spanish study of 1557 college students found that 18.8% of males and 3% of females were at risk of pathological use of IP but only 1.7% of males and 0.1% of females were using IP pathologically (Ballester-Arnal, Castro-Calvo, Gil-Llario, Gil-Julia, 2017). In a large representative Australian sample, 4.4% of males and 1.2% of females self-reported feeling addicted to IP (Rissel et al., 2017). So, although a clear definition of IP addiction is lacking, a proportion of IP users, males in particular, self-identify as feeling addicted.

Addictions are known to correlate with a range of variables. For instance, there is epidemiological evidence that earlier onset of drug use is a predictor of subsequent drug addiction (Grant & Dawson, 1998). This relationship has also been observed for behavioural addictions, such as problem gambling (Rahman et al., 2012) and, for IP use specifically, earlier age of onset is associated with higher frequency of IP use, longer sessions of IP, and higher scores on IP addiction measures (Harper & Hodgins, 2016). As with other

behavioural addictions (e.g., gambling; Kessler et al., 2008), greater IP use correlates with psychopathology including mood disorders, anxiety, personality disorders, and substance dependence (Harper & Hodgins, 2016; Kraus, Voon, & Potenza, 2016; Sniewski, Farvid, & Carter, 2018), as well as psychosocial factors such as stress tolerance (Griffiths, 2012), interpersonal sensitivity (Brand et al., 2011), and low relationship satisfaction (Daspe et al., 2018). Harper and Hodgins (2016) also found that addictive IP use correlated with addictive alcohol and cannabis use, and problematic gaming and gambling.

Interestingly, time is not a strong predictor of problematic IP use (Brand et al., 2011) and frequency is only weakly correlated (Gola, Lewczuk, & Skorko, 2016), although Harper and Hodges (2016) found that daily or more frequent use of IP correlated with higher scores of IP addiction measures. More religious people report lower levels of IP use (Carroll et al., 2008). However, search engine analysis found that more religious populations accessed IP at a higher rate than their non-religious counterparts, suggesting more religious people may just conceal their IP use (MacInnis & Hodson, 2015).

Despite increasing numbers of people presenting to mental health professionals for pornography related addictive problems (Grubbs, Volk, Exline, & Pargament, 2015), the concept of IP addiction is contentious. Previously, the closest diagnostic construct to addiction in the DSM was dependence, which required the ingestion of, and consequent dependency on, exogenous psychoactive substances. However, the concept of behavioural addictions was acknowledged by the APA with inclusion of Gambling Disorder in the DSM-5 (APA, 2013) and the addition of Internet Gaming Disorder in Section 3 for conditions for further study. IP addiction is not currently included in the DSM-5 and there is a lack of consensus of its conceptualisation and diagnostic criteria (Wéry & Billieux, 2017).

The heterogeneity in human behaviours, whether this be eating, gaming, or shopping, makes distinguishing between normal and pathological behaviour challenging. Addiction as

a construct is defined by a cluster of behaviours (Ley et al., 2014). In his components model of addiction, Griffiths (2005) suggested that addictions of all kinds have several distinct commonalities. These components are salience, mood modification, tolerance, withdrawal, conflict, and relapse. Briefly, salience refers to preoccupation with the addicting substance or activity, cravings, and diminished socialising; mood modification refers to a subjective mood change as a consequence of engaging with the substance or activity; tolerance refers to increasing amounts of the substance or activity to achieve the initial effects; withdrawal symptoms refers to unpleasant physical or psychological feelings, or both of them, when deprived of the substance or activity; conflict refers to interpersonal or intrapersonal conflicts associated with the substance or activity; relapse refers to returning to previous levels of substance use or activity engagement after a period of abstinence. As a key component of their incentive-sensitisation model, Robinson and Berridge (2000) comprehensively describe the psychology of how drug use shifts from recreational use for pleasurable effects (liking) to dependent use to relieve cravings or withdrawal (wanting).

IP addiction refers to sexual behaviours that also involve the Internet and it has been subsumed within two broader frameworks. Firstly, Young, Pistner, O'Mara, and Buchanan (1999) proposed a conceptual framework of Internet addiction in which IP addiction was one of five subsets of behaviours and impulse control problems involving Internet use. These subsets are cyber-relationship addiction, referring to overinvolvement in online relationships; net compulsions, referring to obsessive online gambling and shopping; information overload, referring to compulsive web surfing; computer addiction, referring to obsessive gaming; and cybersexual addiction, referring to compulsive use of the Internet for cybersex (use of the Internet to engage in virtual sex, webcams, sex chat rooms, or meet potential partners; Kafka, 2010) and IP.

The second framework incorporates IP addiction from a psychopathological standpoint. Kafka (2010) proposed hypersexual disorder for consideration for inclusion in the DSM-5 (APA, 2013). As the appellation suggests, hypersexual disorder is characterised by increased intensity and frequency of sexual fantasies, arousal, urges in response to dysphoric mood states, and engagement in sexual behaviours leading to negative consequences (Kafka, 2010). Pornography and cybersex are two potential specifiers under Kafka's proposed criteria.

Despite a study supporting the validity and reliability of the proposed criteria (Reid et al., 2012), the inclusion of hypersexual disorder in the DSM-5 was ultimately rejected. Reasons for this included a dearth of research in areas such as anatomy, neuroimaging, neurobiology, epidemiology, and neuropsychology (Piquet-Pessôa, Ferreira, Melca, & Fontenelle, 2014). There were also concerns about potential forensic abuse of the label, diagnostic criteria lacking specificity, and the possible consequences of pathologizing a fundamental human behaviour (Reid & Kafka, 2014).

The concept of behavioural addictions has caused controversy. In 2011, the American Society of Addiction Medicine (ASAM) defined addiction as loss of control, craving, loss of insight into one's problematic behaviour and personal relationships, and dysfunctional emotional response. Behavioural addiction fits this definition. However, the *raison d'être* of diagnostic labels is to identify clinical cases, but such broad definitions struggle to accomplish this while also presenting the possibility of an explosion in potential behavioural addictions (Starcevic, 2012).

Because there is not a definitive IP addiction model, some researchers have investigated this using the substance addiction model (e.g., Ley et al., 2014). This involves examining how closely the characteristics of IP match those of substance addiction. As mentioned earlier, Griffiths (2005) outlined the addictive components that behavioural and

substance addictions share (i.e., salience, mood modification, tolerance, withdrawal, conflict, and relapse).

Tolerance and withdrawal are controversial criteria for behavioural addictions. Starcevic (2012) questions whether tolerance is a valid criterion for behavioural addictions and whether disorders that do not use this criterion are in fact true addictions. Although problem gambling meets all of the addiction criteria, including tolerance, there are validated scales for problem video game use (PVGU) that do not use this symptom, potentially casting doubt on its status as a true addiction (Starcevic, 2012). This is a relevant consideration for IP addiction since tolerance is not included in the hypersexual disorder criteria either (Kafka, 2010).

Similarly, withdrawal is also a characteristic of substance use addictions and has been demonstrated in one behavioural addiction, namely problem gambling (Rosenthal & Lesieur, 1992). Evidence of withdrawal symptoms in hypersexual disorder may be necessary for it to be acknowledged as an addictive disorder (Reid, 2016). However, in their review of hypersexuality addiction and withdrawal, Blum, Badgaiyan, and Gold (2015) found little empirical evidence of withdrawal states in hypersexual disorder research. Kafka (2010) also could not find empirical evidence for tolerance or withdrawal states for hypersexual disorder but absence of evidence is not evidence of absence; it is possible that they had yet to be sufficiently researched.

Neuroscience has proved useful in searching for this evidence. The mesolimbic dopamine pathway, often referred to as the reward centre, is associated with many characteristics thought to be connected to addiction such as pleasure, reinforcement, reward seeking, and impulsivity (Love, Laier, Brand, Hatch, & Hajela, 2015). It reaches out from the ventral tegmental area and into the nucleus accumbens, and connects to three other regions constituting the reward system; the amygdala (associated with emotions), the

hippocampus (associated with long term memory), and the frontal cortex (associated with executive function; Love et al., 2015).

Robinson and Berridge (2000) proposed that drugs of dependence produce neuroadaptations in the reward and motivation systems in the brain that render these systems hypersensitive to drugs (and related stimuli) leading to the distinction between liking a drug and wanting it. There is now evidence that the same neurobiological and motivational mechanisms that underlie substance addiction also apply to behavioural addiction (Robinson & Berridge, 2008).

The liking versus wanting dichotomy proposed by Robinson and Berridge (2000) was investigated using an experimental design in the context of hypersexual disorder using functional MRI (Voon et al., 2014). A healthy control group and a hypersexual group were shown explicit and erotic videos and were asked to gauge how much they liked each and how much each increased their desire (this measured wanting). They were then shown explicit and erotic videos while having their brain activity monitored. Compared to control participants, hypersexual participants scored higher wanting ratings when shown sexually explicit videos, and they scored higher on measures of liking when shown erotic clips. This demonstrated a dissociation between liking and wanting, consistent with Robinson and Berridge's theory.

When shown explicit videos, the brain imaging revealed that both the control group and hypersexual group showed activity in the same regions of the brain as people addicted to substances, such as cocaine and nicotine, but the hypersexual group had a stronger response. Voon et al. (2014) concluded that the same neural networks appear to underlie both substance and behavioural addictions. Interestingly, participants also reported craving to view more pornography but then not enjoying it when they did view it. Craving is a correlate of addiction and is considered a withdrawal symptom in substance addiction (Tiffany & Wray,

2012). Garcia and Thibaut (2010) suggested that dysphoric mood states experienced during reduction or cessation of pornography use may reflect withdrawal symptoms.

Kühn and Gallinat (2014) conducted an MRI study investigating the correlation of amount of pornography use and the structure and connectivity of brain areas associated with addiction. They found a negative association between amount of pornography use and left putamen activity to sexual cues. The left putamen is known to be activated in response to sexual arousal and its downregulation in response to sexual cues could indicate development of tolerance (Brand, Snagowski, Laier, & Malderwald, 2016). The user may then attempt to overcome this tolerance by searching for novel (Alarcon et al., 2019) or more extreme pornography (Harper & Hodgins, 2016), which the Internet can facilitate. It is notable that Kühn and Gallinat's study was cross-sectional in design and so causality and directionality of the relationships between variables is unknown; hence future research should be longitudinal to address this limitation. Although neurobiological research into IP is relatively nascent, there is emerging evidence supporting its addictive potential.

1.5 Cognitive Mechanisms Associated with IP Addiction

As with substance users (Lopez-Quintero et al., 2011), only a minority of IP users become addicted. Only considering objective measures of addiction (e.g., frequency or time spent using a person's drug or behaviour of choice) may give some indication of addiction, but to gain a more comprehensive understanding it is vital to identify the reasons for why the person uses it (Levin, Lee, & Twohig, 2018). One model that may explain why only some people develop IP addiction is Davis's (2001) cognitive-behavioural model of pathological Internet use. Cognitive-behavioural models have been useful in other behavioural addictions, such as Internet gaming disorder (Dong & Potenza, 2014). This is an important area of research because a more comprehensive understanding of the factors involved in the development and maintenance of IP addiction may enable specifically tailored treatments to optimise treatment outcomes (Brand et al., 2016).

Davis's (2001) model uses a diathesis-stress framework. This assumes that predisposed psychopathology (i.e., diathesis) and life circumstances (i.e., stress) can result in pathological Internet use; that is rather than Internet use causing psychopathology, a pre-existing condition increases the likelihood of maladaptive cognitions and behaviours that lead to pathological Internet use (Caplan, 2002). In this model, the Internet itself, or an application accessed via the Internet, is the stressor. Some examples of maladaptive cognitions associated with psychopathology include rumination, social anxiety, and low self-esteem (Davis, 2001).

Operant conditioning is also an important feature of this model. If a person's use of the Internet is positively reinforced, the behaviour is more likely to be repeated. Secondary reinforcement of stimuli associated with the primary conditioned stimulus can develop and act as situational triggers that maintain pathological Internet use (Davis, 2001). Thus, the maladaptive cognitions associated with the pre-existing psychopathology give rise to pathological Internet cognitions (e.g., obsessing about Internet use, guilt) and behaviours (excessive use) leading to adverse outcomes. A vicious cycle develops in which the cognitions and behaviours associated with pathological Internet use progressively intensify which worsens the already present psychopathologies (Davis, 2001).

A salient aspect of this theory to IP addiction is that Davis (2001) distinguishes between generalised and specific pathological Internet use. Generalised pathological Internet use (GIA) is characterised by the general overuse of the Internet's many applications with no particular favourite (e.g., gaming, shopping, watching videos, surfing for information, etc.). However, it is proposed that someone with GIA may spend time on social aspects of the Internet, such as social networking sites and email, because of the assumption that lack of social support or social isolation leads to excessive virtual communication. GIA is characterised by the person wasting time on the Internet or using it as a dysfunctional coping

strategy to avoid personal problems, leading to their psychosocial responsibilities being unmet, further compounding the problems (Davis, 2001).

Contrastingly, specific pathological Internet use (SIA) is the overuse of specific Internet applications (e.g., shopping or pornography; Davis, 2001). Davis (2001) postulates that a specific psychopathology leads directly to the SIA. For IP addiction to develop, it is assumed that an individual already used pornography pathologically, or has a predisposition to do so, and subsequently found the limitless supply of pornography on the Internet, leading to them overusing IP. Thus, the major distinguishing factor between GIA and SIA is that SIA sufferers would develop similar problematic behaviours in the absence of the Internet, whereas sufferers of GIA would not develop related problematic behaviours if the Internet did not exist.

Brand, Young, and Laier (2014) expanded on Davis's (2001) theoretical model by going into more detail regarding psychopathology, cognitions associated with Internet use, coping styles, and positive and negative reinforcement for both GIA and SIA. Brand et al. (2014) also postulate that psychopathological symptoms such as depression, anxiety, or stress are necessary for the development and maintenance of SIA. Psychopathological symptoms of depression or stress may lead to hurried decision making in which not all options are adequately considered, and the decision made may focus on short-term and potentially high rewards (Starcke & Brand, 2016). That is, coping with stress and mood regulation may influence the decision a person makes in how to manage these experiences (Brand et al., 2016).

Specific cognitive mechanisms such as expectancies and coping styles have an important role to play in managing stress and mood regulation (Brand et al., 2014). People who have positive expectancies from the use of specific Internet applications may be more likely to derive gratification from them and consequently be more inclined to return to the

same application frequently, leading to gradual loss of control of use, which is characteristic of addictive behaviours. Slipping into this addictive use of Internet applications is more likely if the person uses it as a coping mechanism to avoid personal problems.

Brand, Laier, and Young (2014) conducted a study to test this theory in the context of GIA. First, they measured core characteristics including depression, anxiety, stress vulnerability, and self-esteem to test whether these predicted GIA. They then used measures of coping styles and Internet use expectancies to test whether these constructs mediated the relationship between core characteristics and symptoms of GIA. They found that the core characteristics did significantly correlate with GIA using bivariate analysis. However, when the hypothesised mediator variables were added into the structural equation model, the significant direct relationships between core characteristics and GIA reduced in magnitude and were no longer significant. This indicates that the core characteristics do not themselves directly influence GIA, but their effect is mediated by either or both dysfunctional coping styles and the persons Internet use expectancies (Brand et al., 2014). Thus, although depression, for example, correlates with GIA, GIA may not develop based on this alone, but the probability increases if the person also has a dysfunctional coping style, positive or avoidant Internet use expectancy, or both of them. Although these results provide empirical evidence for the theoretical model, the study used a non-clinical sample. Moreover, the study focussed on GIA and whether the same principles apply to SIAs such as IP addiction is unknown.

Notably, according with Brand et al. (2014), a study focusing on the SIA of Internet shopping also found that expectancies that Internet use would provide pleasure or distraction from problems also mediated the relationship between a person's core characteristics and problematic online shopping (Trotzke, Starcke, Müller, & Brand, 2015). Furthermore, a study on men with Internet sexual problems found that 81% used IP for distraction and 57%

to deal with stress (Cooper, Galbreath, & Becker, 2004). Cooper et al. (2004) also found that men who were having trouble with their real-life sex lives were also more likely to use IP, possibly because they lack the attributes to find real-life partners who meet their needs. These results imply that problematic users have maladaptive motivations and dysfunctional coping strategies, both of which are also established factors in substance addiction (Griffiths, 2012).

Mood modification and regulation is acknowledged as an important characteristic of addictions (Egan & Parmar, 2013). Laier and Brand (2014) found that dysfunctional use of sex was a mediating factor in the relationship between sexual excitability and predisposition to IP addiction. This suggests that people who have high sexual excitability may be more prone to IP addiction if they use IP to regulate their mood or manage stress. Levin et al. (2018) investigated experiential avoidance in the context of IP addiction. Experiential avoidance refers to the desired reduction or control of distressing internal stimuli (e.g., negative emotions) despite the consequences that may follow (Hayes et al., 2004), and has been found to contribute to a range of disorders including addiction (Levin et al., 2012). Levin et al. found that there were many reasons people watched IP including sexual excitement and curiosity but use for experiential avoidance was most strongly associated with negative consequences. Moreover, results from another study found that perceived stress and emotional avoidance were both associated with IP use while IP use was associated with improvement in mood (Laier & Brand, 2017).

Hence, it is possible that people with psychopathology are more prone to distressing emotions, with these experiences triggering the use of IP to regulate emotions. Because IP use improves mood and offers distraction, positive expectancies of IP use develop, and it becomes used more frequently to manage feelings of anxiety or avoiding problems and gradually progresses to become a dysfunctional coping strategy. In this example, the

person's expectancies and coping styles are positively reinforced. There is also a process of negative reinforcement as the person experiences relief from their psychopathological symptoms. Thus, the psychopathology, and the influence of the reinforcement mechanisms on the persons expectancies, coping styles, or both of them, increase the probability of their use of IP becoming an addiction.

1.6 Conclusion

Definitional problems and a lack of diagnostic criteria make it challenging to measure the magnitude of IP addiction, or to establish whether it even exists. Nonetheless, it seems there is a small yet significant proportion of IP users who think they have a problem with IP and demonstrate loss of control, amongst other consequences. There are a number of directions for future research to explore. The APA recognising behavioural addictions with the inclusion of Gambling Disorder in the DSM-5 could signify that other behavioural addictions will also be acknowledged in future. Thus, it is important to overcome the definitional barriers associated with IP addiction insofar as whether it is part of a broader disorder, such as Hypersexual Disorder or a disorder in its own right, and gather more evidence to develop diagnostic criteria to enable more precise research and improved public health initiatives. From a neuroscience perspective, research could utilise longitudinal designs to reveal whether the brain structure differences that correlate with IP use are caused by IP use or are a result of it. The use of clinical samples is also an area that would be potentially valuable.

Davis's (2001) cognitive-behavioural framework elaborated on by Brand et al. (2016) has evidence to support it for GIA and Internet shopping. It is reasonable to hypothesise that the same or similar principles could apply to IP addiction, although this remains to be demonstrated empirically. With the increasing number of people seeking treatment for IP addiction, the development of a comprehensive understanding of the cognitive mechanisms of IP addiction is essential so that these can be effectively targeted to optimise treatment.

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Correlates and Cognitive Mechanisms Associated with Internet Pornography Use

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Abstract

The proliferation of Internet pornography (IP) use coincides with increasing numbers of people pursuing IP addiction treatment. This study ($N = 238$) aimed to test whether cognitive mechanisms (IP use expectancies and coping styles) mediate the relationship between psychopathology and IP addiction. An online survey measured a range of correlates, IP use expectancies, coping styles, and IP addiction. Generally, the relationship between psychopathology and IP addiction for males ($n = 120$) was mediated by IP use expectancies and dysfunctional coping styles but for females ($n = 118$) only IP use expectancies mediated the relationship, dysfunctional coping styles did not. Discussion focuses on gender differences and treatment implications.

Correlates and Cognitive Mechanisms Associated with Internet Pornography Use

Introduction

Internet-pornography-viewing-disorder, problematic-Internet-pornography-use, and Internet pornography (IP) addiction all broadly refer to the same construct, wherein people have developed a preoccupation with IP, have lost control over their use of IP, and experience one or more of interpersonal, occupational, or psychosocial consequences (Alarcón, Iglesia, Casado, & Montejo, 2019; Harper & Hodgins, 2016; Kor et al., 2014). Recent articles elucidate the similarities that overuse of certain substances and behaviors have in the development and maintenance of addiction (e.g., Brand, Young, & Laier, 2014; Griffiths, 2005; Love, Laier, Brand, Hatch, & Hajela, 2015), hence we hereafter use the term IP addiction.

IP addiction is a controversial concept. This is partly because, historically, addictive disorders have focused on substance dependence (e.g., alcohol dependence; American Psychiatric Association [APA], 1994). IP addiction is not a recognized disorder in the DSM-5 (APA, 2013), in part because there is a lack of scientific literature supporting its inclusion (Sniewski, Farvid, & Carter, 2018). However, with the inclusion of Gambling Disorder into the DSM-5 and the inclusion of Internet Gaming Disorder in Section 3 (conditions for further study), the APA has now recognized the concept of behavioral addictions (Alarcón et al., 2019), and this may open the door to recognition of other behavioral addictions, including IP. For this to occur, further scientific evidence for this potential disorder must be documented.

1.1 Pornography and the Effect of the Internet

There is no standard definition of pornography (Short, Black, Smith, Wetterneck, & Wells, 2012). However, representation of nudity and sexualized behaviors is reliably considered to be pornographic in nature (Campbell & Kohut, 2017). For the purposes of this study, IP refers to sexualized behaviors for the purpose of sexual stimulation on the medium of the Internet.

The Internet has facilitated a substantial increase in the use of pornography. Between the 1970s to 2000s, there has been a 36% increase in the use of pornography by men and a 29% increase by women (Price, Patterson, Regnerus, & Walley, 2015). In 2006, 12% of all websites were pornographic in nature while 25% of all Internet searches were for pornography (approximately 68 million searches per day; Ropelato, 2006). In Pornhub's 2019 year in review, it was reported that their site had 42 billion visits (roughly 115 million

per day) and users performed 39 billion searches, while the Shift Project (2019) reported that IP videos constituted 27% of all Internet traffic.

Cooper (1998) suggests that the Internet has facilitated the increase in pornography use via the Triple A Engine: Access, Affordability, and Anonymity. Virtually anyone with an Internet connection can access IP for no extra cost once the connection fee has been met while feeling anonymous liberates people to explore topics that they may not otherwise explore.

It has been estimated that in the US, 87% of males and 31% of females use IP at any level (Carroll et al., 2008), while 46% of males and 16% of females use IP on a weekly basis (Regnerus, Gordon, & Price, 2015). Carroll et al. (2008) also reported that 20% of males use IP daily or every other day compared to only 3.2% of females. Poulsen, Busby, and Galovan (2013) report that although males do use IP at a higher rate, female use has been rising.

1.2 IP Harms and Correlates

In tandem with the increase in IP use comes an increase in the number of people seeking help for addictive IP-related symptoms (Carroll et al., 2008). However, IP addiction remains a contentious construct, with no recognized diagnostic criteria (Grubbs, Volk, Exline, & Pargament, 2015) meaning that studies rely on self-report designs. Estimates of IP addiction range from 4.4% to 18% for males and 1.2% to 7% for females (Rissell et al., 2017; Ross, Månsson, & Daneback, 2011). Hence, a non-trivial proportion of IP users, particularly males, report feeling addicted.

There have been a number of reported harms that accompany IP addiction including disinterest in sexual relationships with a real partner (Poulsen et al., 2013), adverse effects on self-esteem and emotional state, impaired sexual arousal and orgasm (Schneider, 2000), psychological distress (Egan & Parmar, 2013), inappropriate use of pornography (e.g., in the workplace; Cooper, Golden, & Kent-Ferraro, 2002), and erectile dysfunction (Park et al., 2016).

As with other addictions, IP addiction correlates with a range of factors. Age of onset is associated with more frequent and addictive use, and longer sessions of IP (Harper & Hodgins, 2016). Greater IP use also correlates with mood disorders, anxiety, and personality disorders (Harper & Hodgins, 2016; Kraus, Voon, & Potenza, 2016; Sniewski, Farvid, & Carter, 2018). Although it is established that anxiety correlates with IP use, it is possible that social anxiety has a stronger correlation still given that IP enables the user to experience sexual stimulation without any social pressure that may come with real life sexual situations (Short, Wetterneck, Bistricky, Shutter, & Chase, 2016). IP use is associated with personality

factors including stress tolerance (Griffiths, 2012) and interpersonal sensitivity (Brand et al., 2011), as well as social circumstances including relationship dissatisfaction and sexual dissatisfaction (Daspe, Vaillancourt-Morel, Lussier, Sabourin, & Ferron, 2018; Peter & Valkenburg, 2009). IP use also correlates with other addictive behaviors including alcohol and cannabis use, as well as gaming and gambling (Harper & Hodgins, 2016). Time spent using IP and frequency of use are only weakly correlated (Brand 2011; Gola, Lewczuk, & Skorko, 2016), although daily or more frequent use is associated with higher IP addiction scores (Harper & Hodgins, 2016). Self-reported strength of religious beliefs may be a protective factor against IP use (Carroll et al., 2008).

Because IP addiction lacks diagnostic criteria, some researchers argue IP addiction should be categorized as a form of Hypersexual Disorder (Kafka, 2010), or as a specific form of Internet addiction (Young, 2008). However, IP addiction may be distinct from Hypersexual Disorder given that people can engage with it anonymously and without the potentially anxiety provoking social aspect of real sex (Sniewski et al., 2018). Robinson and Berridge (2000) proposed their incentive-sensitization model of addiction in which addictive psycho-active substances cause neuroadaptations in the reward and motivation systems in the brain leading to addicted individuals becoming hypersensitive to drugs and associated stimuli, moving them from liking drug use to wanting it. There is now neuroscientific evidence that supports the concept that certain substances and behaviors affect the reward systems in the brain in similar ways, suggesting that IP addiction could be classified as a behavioral addiction (Love et al., 2015; Kühn & Gallinat, 2014; Voon et al., 2014). This comports with Griffiths' (2005) addictive components model that highlights commonalities of both substance and behavioral addictions (i.e., salience, mood modification, tolerance, withdrawal, conflict, and relapse).

1.3 Cognitive Mechanisms

In the area of Internet addiction research, Davis (2001) proposed his cognitive-behavioral model of Internet addiction. This theory distinguishes between generalized Internet addiction (GIA) and specific Internet addiction (SIA). GIA is characterized by multidimensional overuse of Internet applications, with no particular favorite, while SIA relates to overuse of specific applications (e.g., IP; Davis, 2001). Notably, of all the Internet's applications, IP may have the highest addictive potential (Meerkerk, Eijnden, & Garretsen, 2006). Davis' model uses a diathesis-stress framework, assuming that predisposed psychopathology (and associated maladaptive cognitions, such as rumination, or cognitive

distortions, such as low self-esteem, or both of them), environmental factors, and reinforcement mechanisms can result in pathological Internet use (Caplan, 2002).

This model was further elaborated by Brand et al. (2014). Addiction in this model is also predicated on underlying core characteristics including psychopathology (depression, anxiety) and personality factors (stress vulnerability, low self-esteem), and cognitions associated with Internet use (i.e., coping styles and positive or avoidant Internet use expectancies), which could be applied to either GIA or SIA. Pertinent to the current study, people who are prone to developing an SIA will have needs that they believe the specific Internet application can fulfil. Cognitive mechanisms play an important role in the development and maintenance of an SIA. In the context of IP use, people who have positive expectancies and experience gratification from their use of IP receive positive reinforcement while people who have avoidant expectancies and obtain relief from unwanted emotions associated with psychopathological (e.g., anxiety) or personality (e.g., stress) characteristics receive negative reinforcement. It is proposed that the interaction between psychopathology, personality, cognitive mechanisms, and reinforcement processes can lead to the development and maintenance of SIA for some people (Brand et al., 2014).

Brand et al. (2014) tested this model in the context of GIA and found that dysfunctional coping styles and positive or avoidant Internet use expectancies mediated the relationship between core characteristics (psychopathology and personality) in people with GIA. However, people with psychological or personality vulnerabilities did not develop GIA if the maladaptive coping styles, or positive Internet use expectancies, or both of them, were absent. This indicates the importance that cognitions play in the development of GIA and could be used to inform treatment approaches in future. However, the authors of this study noted that this model needed to be investigated in the context of SIA.

Each of the pathways that mediated the relationship between core personality characteristics and tendency toward addictive use of an Internet application, as specified in the model proposed by Brand et al. (2014; i.e., coping styles and Internet expectancies), were tested in two separate studies focusing on SIAs. Firstly, Laier and Brand (2014) found that the relationship between sexual excitement and tendency towards cybersex addiction was mediated by dysfunctional use of sex. Secondly, in the context of Internet shopping, Trotzke, Starcke, Müller, and Brand (2015) found that the relationship between shopping excitability and tendency towards addictive shopping was mediated by online shopping expectancies.

Mood regulation is a significant factor in addictive disorders (Egan & Parmar, 2013), and IP addiction seems to be no exception. Laier and Brand (2017) found that problematic IP

use correlated negatively with feeling good and calm and correlated positively with stress. Furthermore, they found that using IP improved mood and increased feeling calm. Cooper, Galbreath, and Becker (2004) found that 81% of men with problematic sexual Internet use used IP as a distraction technique, while 57% used IP as a coping strategy to manage stress. However, Levin, Lee, and Twohig (2018) found that compared to people who use IP for pleasure, people that use IP to avoid aversive emotional states also tend to experience more negative consequences from their use, possibly leading to a vicious cycle.

Laier and Brand (2014) used a measurement tool that specifically measured dysfunctional use of sex and its importance in the development of IP addiction. In this study, we explore whether higher scores on an addictive IP measure correlate with a generic measure of dysfunctional coping because it has been suggested that IP use may be particularly addictive (Meerkerk et al., 2006) and hence might be used as a general dysfunctional coping mechanism.

1.4 The Present Study

There are two main aims for this study. Firstly, as noted, IP addiction is not currently acknowledged as a disorder by the APA, partly because there is a dearth of supporting evidence. The creation of validated measures will help to generate operational definitions, measure prevalence, develop norms, and classify clinical cases (Short et al., 2012). Thus, we hope to contribute to the literature by providing evidence that IP addiction can be considered a behavioral addiction. We will use adapted Internet Gaming Disorder DSM-5 (APA, 2013) questions to fit IP addiction, as per Harper and Hodgins (2016). This scale, which we will refer to as the IP Scale (IPS), broadly covers the components proposed in the model of addiction by Griffiths (2005). Our first aim is to provide correlates of IP addiction as measured with the IPS. We decided to use this adapted scale for IP because if the APA do continue to consider behavioral addictions in future, the criteria may focus on characteristics that these conditions have in common with some disorder specific differences, analogous to substance addiction criteria in the DSM-5 (APA, 2013).

Hypothesis 1: Psychopathology (depression, anxiety, social anxiety), stress, alcohol use, gaming, positive and avoidant expectancies of IP use, time spent using IP, and dysfunctional coping will correlate positively with higher scores on the IPS; males will score higher than females on the IPS.

Hypothesis 2: There will be negative correlations between scores on the IPS and age, age at first exposure, self-esteem, satisfaction with life, and relationship satisfaction.

Our second aim is to test the psychopathology and stress part of the cognitive-behavioral model proposed by Brand et al. (2014), in the context of IP addiction. The literature reviewed indicates that dysfunctional coping styles and Internet expectancies play a role in IP addiction and Internet shopping addiction, but whether they mediate the relationship between psychopathology and IP addiction remains to be seen. Plausibly, psychopathology (depression, anxiety, social anxiety) and stress lead to adverse emotional states, which may be alleviated or avoided through the use of IP. Additionally, people that also have dysfunctional coping styles, IP use expectancies, or both of them, may be more prone to developing IP addiction from the resulting interplay between psychopathology, personality, cognitive mechanisms, and reinforcement processes. From a psychological perspective, it is important to understand the development and maintenance of IP addiction, in order to develop efficacious treatments. Therefore, if cognitive mechanisms do play a role in IP addiction this is an area that can be focused on in the development of psychological treatments.

Hypothesis 3: Positive and avoidance IP use expectancies will mediate a relationship between psychopathology and stress, and higher scores on the IPS.

Hypothesis 4: Dysfunctional coping styles (denial, substance use, and behavioral disengagement) will mediate a relationship between psychopathology and stress, and higher scores on the IPS.

Method

2.1 Participants

The sample for this study comprised both Level 1 Psychology students from the University of Adelaide and members of the general public. The students were invited to participate in return for course credit; social media and Reddit Internet forums were used to recruit members of the general community. Participants were required to be proficient in English and 18 years or older.

2.2 Materials

2.2.1 Demographics questionnaire

A brief demographic questionnaire asked for age, gender, relationship status, employment status, and level of religiosity.

2.2.2 Depression Anxiety and Stress Scales

Depression, anxiety, and stress were assessed via the short-form Depression, Anxiety and Stress Scales (DASS-21; Henry & Crawford, 2005). The DASS-21 uses 21 statements (e.g., I found it difficult to relax) which are rated on a four-point scale from 'never' to 'almost always'.

2.2.3 Social Interaction Anxiety Scale Short Form

Social anxiety was measured using the six-item Social Interaction Anxiety Scale Short Form (SIAS-SF; Fergus, Valentiner, McGrath, Gier-Lonsway, & Kim, 2012). Participants rate each item from 0 (not at all) to 7 (extremely).

2.2.4 Alcohol Use Disorders Identification Test

Participants who used alcohol completed the Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). The AUDIT is a 10-item questionnaire with higher scores indicating greater alcohol use; scores of 8-15 are indicative of hazardous alcohol use and 20 or more possibly indicating alcohol dependence (Babor et al., 2001).

2.2.5 Relationship Assessment Scale

Participants who were currently in a relationship had their relationship satisfaction measured by completing the seven-item Relationship Assessment Scale (RAS), with higher scores indicating greater relationship satisfaction (Hendrick, 1988).

2.2.6 Internet Gaming Disorder Test

The 10-item Internet Gaming Disorder Test (IGDT-10; Király et al., 2017) was completed by participants who reported playing computer games. Items are scored from 0 (never) to 2 (often), with higher scores indicating more problematic gaming.

2.2.7 Self-Esteem Scale

Self-esteem was measured using the Self-Esteem Scale (Rosenberg, 1979), which is comprised of 10-items. Participants rate each item on a scale from 1 (strongly agree) to 4 (strongly disagree).

2.2.8 Adapted Internet Gaming Disorder DSM-5 Questions to fit IP Addiction (IPS)

We used questions developed by Petry et al. (2014) based on the DSM-5 (APA, 2013) diagnostic criteria for Internet Gaming Disorder, which were modified by Harper and Hodgins (2016) to fit IP addiction criteria. There are 14-items, which are scored from 0 (not at all) to 7 (often).

2.2.9 Internet Pornography Use Expectancies Scale

To measure Internet use expectancies, we adapted an 8-item scale developed by Brand et al. (2014) to fit IP use expectancies. Minimal rephrasing was necessary to adapt these items. The first four items refer to positive expectancies and the second four items refer to avoidance expectancies. Each item is scored from 0 (completely disagree) to 7 (completely agree).

2.2.10 Brief COPE

The Brief COPE (Carver, 1997) measures coping styles across 14 different dimensions. We used three subscales for this study; denial, substance use, and behavioral disengagement to represent dysfunctional coping. Each subscale is comprised of two items that the participants rate from 1 (I haven't been doing this at all) to 4 (I've been doing this a lot).

2.2.11 Satisfaction with Life Scale

Participants completed the five-item Satisfaction With Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985) to assess overall life satisfaction. Each item is rated from 1 (strongly disagree) to 7 (strongly agree).

2.2.12 Frequency/Volume of Internet Pornography Use Questions

Participants answered five questions related to frequency of IP use, duration of IP use sessions, age at first exposure, whether frequency and time spent watching IP had decreased

(1) or increased (7), and whether the IP searched for had changed from less extreme (1) or more extreme (7).

2.3 Procedure

Both the student and community samples accessed the survey via a URL link provided on either the School of Psychology Research Participation System, or on social media and Reddit forums, respectively. Respondents read the information sheet pertaining to the nature of the study, confidentiality, and that the submission of their survey responses was taken as consent to use their data for the study before proceeding to the survey. Data were collected via SurveyMonkey for community participants and Qualtrics for students and there were no time constraints for completion. The study received institutional HREC approval (approval code: 20/04).

Statistical analysis was undertaken using SPSS Statistics 26.0. Relationships between the various measured variables were assessed using Pearson correlations, independent samples *t*-tests, and analysis of variance (ANOVA). The mediation analysis was carried out using the Process Macro v3.4.1 for SPSS 26 (Hayes, 2018).

Results

3.1 Descriptive Statistics

The total number of participants for the study was $N = 337$, $n = 121$ Level I students and $n = 216$ from the community. $n = 90$ participants were excluded due to incomplete data, while $n = 6$ participants were excluded as they identified as non-binary ($n = 5$) or trans ($n = 1$), and $n = 3$ participants were excluded because they were under 18 years old. Hence, the sample used for analysis was $N = 238$; $n = 109$ were students and $n = 129$ were from the community.

Of the 238 participants, 120 were male and 118 were female, while the mean age was 25.7 ($SD = 9.04$ years, range = 18-to-58 years). With regards to relationship status, 116 participants reported being single (48.7%), 60 reported dating (25.2%), and 62 reported being in a serious relationship (26.1%). The most common response for employment was to be working casually/part-time (105 people, 44.1%), with 72 participants (30.3%) reporting being unemployed, and 61 participants (25.6%) working fulltime. Importance of religion was low ($M = 2.46$, $SD = 1.76$, range = 1 to 7), with a large proportion of participants reporting religion not being important at all ($n = 109$, 45.8%).

Previous studies have reported gender differences in the use of IP with males being heavier users (Campbell & Kohut, 2017). Moreover, we also recruited participants from two sources (students and the general community) so we performed an ANOVA to assess whether gender and sample differed for the main outcome of the study, scores on the IPS. Gender had a significant effect ($F(1, 234) = 41.31$, $p < .001$), with males scoring higher (see Table 2). However, recruitment source had no effect ($F(1, 234) = .46$, $p = .500$) and there was no interaction effect between participant recruitment source and gender ($F(1, 234) = .54$, $p = .465$). In light of these analyses, we conducted our mediation analyses separately for males and females but not for participant recruitment source.

Table 1 shows descriptive statistics for the non-IP scales. The only significant psychopathological gender difference was for anxiety, with females ($M = 4.86$, $SD = 3.98$) scoring higher than males ($M = 3.58$, $SD = 3.01$), $t(217.8) = 2.80$, $p = .005$. The effect size for this difference was small-to-medium ($d = .36$). Females scoring higher in anxiety is a consistent finding in psychological literature (Feingold, 1994) and has been found to be culturally invariant (Costa, Terracciano, & McCrae, 2001). Males ($M = 9.75$, $SD = 7.20$) scored significantly higher than females ($M = 6.26$, $SD = 4.22$) for the use of alcohol, $t(150.2) = 3.93$, $p < .001$, which is also consistent with previous findings (Wilsnack, Vogeltanz, Wilsnack, & Harris, 2000). There was a medium effect size for this difference ($d = .59$).

According to the scoring of the AUDIT, 0-to-7 indicates low risk whereas 8-to-15 indicates increasing risk. Hence for our sample, females were in the low risk range whereas males were in the increasing risk range.

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For the IP specific data (see Table 2), males ($M = 31.2, SD = 23.5$) scored significantly higher than females ($M = 12.2, SD = 13.5$) on the IPS, $t(190.3) = 7.64, p < .001, d = .99$. This is consistent with much of the research on IP use, which shows males are more afflicted with IP addictive tendencies (Harper & Hodgins, 2016). Males also had significantly more sessions ($M = 18.2, SD = 13.4$) of IP per month than females ($M = 4.69, SD = 7.21$), $t(182.9) = 9.69, p < .001, d = 1.25$. Average session duration of IP use in minutes was also significantly higher for males ($M = 28.8, SD = 25.1$) compared to females ($M = 16.6, SD = 18.8$) $t(236) = 4.24, p < .001, d = .55$. Predictably, the number of minutes per month of IP use was also significantly higher for males ($M = 542.9, SD = 579.4$) than females ($M = 136.3, SD = 318.6$), $t(185.6) = 6.72, p < .001, d = .87$.

There were also significant differences for changes in frequency and extremity of IP use in the last year between genders. On average males reported a small increase in IP use over the course of the last year, whereas as females reported a decrease with the difference between males and females being significant ($t(236) = 2.79, p < .05, d = .37$). Both genders reported that the content of their IP use had become more extreme over the last year, although there was a significant difference between them with males ($M = 4.58, SD = 1.32$) scoring higher than females ($M = 4.25, SD = 1.19$), $t(234.1) = 2.03, p < .05, d = .26$). In previous research, the age of first exposure to IP had been significantly different between genders with males being exposed earlier than females (Harper & Hodgins, 2016). However, in our study although the mean at which males first saw IP was 14.5 ($SD=5.17$ years) and females was 15.8 ($SD = 5.64$), this difference was not significant.

Table 2 shows the scores for the cognitive mechanisms theorized to be involved in the development and maintenance of IP addiction. Males in our sample scored significantly higher for positive IP use expectancies ($M = 20.2, SD = 6.72$) than did females ($M = 12.9, SD = 9.76$), $t(207.2) = 6.79, p < .001, d = .88$) as well as males scoring higher for avoidance IP use expectancies ($M = 9.79, SD = 7.46$) compared to females ($M = 4.10, SD = 5.78$), $t(223.9)$

= 6.58, $p < .001$, $d = .85$). Males also scored significantly higher on all three of dimensions of the dysfunctional coping measure, the COPE (see Table 2). In summary for the IP related variables, males scored higher than females on every measure (except for first exposure, which was not significant). The effect sizes ranged from small-to-large but were predominantly medium-to-large.

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3.2 Hypothesis 1

Hypothesis 1 was supported insofar as scores on the IPS had significant and positive correlations with psychopathology (depression, anxiety, social anxiety), stress, alcohol use, gaming, positive and avoidant IP use expectancies, IP session length, number of IP sessions per month, and dysfunctional coping (see Tables 3 and 4). The correlations ranged from small for IPS and anxiety ($r = .13$, $p < .05$) to large for IPS and avoidant expectancies ($r = .82$, $p < .01$), although the majority of the correlations were in the medium range. Males scored significantly higher on the IPS than females (see Table 2).

3.3 Hypothesis 2

Hypothesis 2 was largely supported with significant negative correlations in the small-to-medium range found between scores on the IPS and age at first exposure ($r = -.34$, $p < .01$), satisfaction with life ($r = -.43$, $p < .01$), and relationship satisfaction ($r = -.34$, $p < .01$; see Tables 3 and 4). Moreover, the lower the age at first exposure to IP the higher the number of IP sessions per month ($r = -.36$, $p < .01$), the more extreme the content searched for becomes ($r = -.15$, $p < .05$), and the higher the IP use expectancies (positive expectancy, $r = -.30$, $p < .01$; avoidance expectancy, $r = -.28$, $p < .01$) and dysfunctional coping (COPE denial, $r = -.18$, $p < .01$; substance use, $r = -.24$, $p < .01$; behavioral disengagement, $r = -.19$, $p < .01$). However, although there was a negative relationship between IPS scores and age ($r = -.11$) this was not significant. The relationship between self-esteem and IPS scores was the opposite of what was expected, being significantly positively correlated ($r = .34$, $p < .01$).

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We used the Preacher and Hayes (2008) product-of-coefficients strategy for the mediation analyses. This is a non-parametric approach that uses bootstrapping to generate confidence intervals to test for significance. Significance is indicated if the confidence intervals do not contain zero. For each mediation model, the relevant variables were entered into the mediation model as per the hypotheses.

3.4 Hypothesis 3

Hypothesis 3 proposed that positive and avoidant IP use expectancies will mediate a relationship between psychopathology, stress, and higher scores on the IPS. We conducted mediation analysis for males and females separately due to the significant differences found between them in the earlier analyses, above. We decided to conduct a parallel mediation model using each of the IP use expectancies (positive and avoidance) as separate mediators, as opposed to combining them. This is because they are related but distinct constructs with positive expectancies measuring positive reinforcement and avoidance expectancies measuring negative reinforcement (Brand et al., 2014). Figures 1 and 2 show the relevant conceptual and statistical models, respectively.

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Table 5 shows the results for males. Hypothesis 3 was largely supported insofar as positive and avoidance IP use expectancies did indeed significantly mediate the relationship between depression, stress and social anxiety, and IPS scores as indicated by the bootstrapped confidence intervals not containing zero. However, for the relationship between anxiety and IPS scores, only avoidance IP use expectancies mediated this relationship, positive IP use expectancies did not. The confidence intervals for the direct effect of depression, anxiety,

and stress on IPS score contained zero indicating the direct effects were no longer significant after including the mediators. The direct effect of social anxiety on IPS score remained significant after including the mediators.

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The mediation results for females were mixed (see Table 6). The relationship between depression and IPS scores was mediated by both positive and avoidance IP use expectancies. The relationship between anxiety and social anxiety, and IPS scores were only mediated by avoidance IP use expectancies. For stress, neither positive nor avoidance IP use expectancies mediated the relationship with IPS scores. The confidence intervals for the direct effect of depression, anxiety, and social anxiety on IPS score was no longer significant after including the mediators. The direct effect of stress on IPS scores remained significant after including the mediators.

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3.5 Hypothesis 4

Hypothesis 4 proposed that dysfunctional coping styles (denial, substance use, and behavioral disengagement) mediate a relationship between psychopathology, stress vulnerability, and higher scores on the IPS. We decided to sum the three scales (denial, substance use, and behavioral disengagement) into one factor representing dysfunctional coping. This is because they are three dysfunctional coping styles taken from the coping measure the Brief COPE and were highly correlated (Carver, 1997). Figures 3 and 4 show the relevant conceptual and statistical models, respectively.

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Table 7 shows the results for males and females. Dysfunctional coping mediated all of the relationships between depression, anxiety, stress, social anxiety, and IPS scores for males. All of the direct effects of the predictor variables and IPS scores remained significant after including the mediator. Contrastingly, for females dysfunctional coping did not mediate any of the relationships between depression, anxiety, stress, social anxiety and IPS scores.

Discussion

4.1 Aims of Study

Internet pornography (IP) use has proliferated for a number of years and with it so has the number of people presenting to mental health professionals for help with addictive tendencies towards using IP. The current study first aimed to provide correlates of IP use as measured using the IPS (criteria for Internet Gaming Disorder adapted for IP addiction by Harper & Hodgins, 2016). For the most part, the correlations were in the expected directions although the correlation between age and IPS were not significant and the correlation between IPS and self-esteem was in the opposite direction to that expected.

The second aim of the study was to test the psychopathological and stress part of the cognitive-behavior model of general Internet addiction proposed by Brand et al. (2014) in the context of IP addiction, using Internet use expectancies and dysfunctional coping styles as mediating variables. We conducted the mediation analysis separately for males and females due to the significant differences found between them on the IPS. For males, we found that IP use expectancies and coping styles played a significant role in mediating addictive IP use. Specifically, positive and avoidance IP use expectancies mediated relationships for all the psychopathologies and stress, and IPS score. The exception was anxiety, which was only mediated by avoidance expectancies, while dysfunctional coping mediated all relationships between psychopathologies and stress, and IPS score.

The picture was quite different for females. Avoidance IP use expectancies mediated relationships between depression, anxiety and social anxiety, and IPS score, while positive IP use expectancies only mediated the relationship between depression and IPS score. The relationship between stress and IPS score was not mediated by positive or avoidance IP use expectancies. Dysfunctional coping also did not mediate any of the relationships between psychopathologies and stress, and IPS score.

4.2 Correlations

As expected, the IPS correlated positively with the following variables: psychopathology (depression, anxiety, social anxiety), stress, alcohol use, gaming, positive and avoidance IP use expectancies, IP session length, number of IP sessions per month, and dysfunctional coping. We anticipated that higher scores on the IPS would correlate with psychopathology and stress based on the cognitive-behavioral theory of addictive Internet use first hypothesized by Davis (2001). Davis suggested that psychopathology may be a predisposing factor in the potential development for IP addiction and that maladaptive cognitions such as low self-esteem may act as a further contributing factor. Brand et al.

(2014) elaborated on this theory and found evidence for their suggestion that cognitions involved in addictive behavior would mediate the relationship between psychopathology and stress, and general Internet addiction (GIA). We found that in applying IP use expectancies and dysfunctional coping to IP use correlated positively with scores on the IPS; that is that people who score higher on the IPS also score higher on these maladaptive cognitions.

Another interesting finding is the significant associations between IPS scores and scores on the other addictive behaviors in our study; alcohol use and gaming. Previous studies have also found a relationship between addictive tendencies, including behavioral addictions. Petry, Stinson, and Grant (2005) found that 72% of problem gamblers used alcohol problematically, 38% used drugs problematically, and 60% were dependent on nicotine. Kessler et al. (2008) reported that problem gambling predicted future drug or alcohol dependence with an odds ratio of 9.8, while drug or alcohol dependence predicted future problem gambling at an odds ratio of 8.8. While Harper and Hodgins (2016) found that IP addiction correlated with higher rates of gambling, alcohol and cannabis use. That these addictive behaviors appear to cluster raises the possibility that some people have a generalized vulnerability to addiction, which could be an area for future research.

Concerning the relationship between IP use and gaming: according to Davis's (2001) cognitive-behavioral model of Internet addiction, stimuli related to the primary conditioned stimulus can be secondarily reinforced and become situational cues that contribute to the development and maintenance of the addiction. Hence, it is possible that gaming and IP are mutually reinforcing since they can both be accessed using the same technology. Additionally, because both IP and gaming were also associated with psychopathology and stress, it is possible that these behaviors may fulfil needs associated with these conditions such as distraction from negative emotional states. It is also possible that sexual and social needs could be fulfilled using IP and online gaming as safety behaviors to avoid the uncomfortable feelings associated with real life social situations.

While it was anticipated that lower self-esteem would be associated with higher IP use the reverse finding, that as self-esteem increased so did IP use, was curious. However, it is possible that this finding could be explained by a couple of factors. Firstly, there may be self-perceived positives of IP use. IP can be used as a source of sexual education which can enhance sexual repertoire, and this increased self-perceived prowess could lead to heightened feelings of sexual self-esteem (Kvalem, Træen, Lewin, & Štulhofer, 2014). Secondly, the current study used a non-treatment seeking sample and it seems plausible that people who use

IP problematically may be distressed by their use and not share the same self-perceived positives of IP use, which could negatively affect their self-esteem.

A significant negative correlation was also found between relationship satisfaction and frequency of IP use and addictive IP use. The relationship between lower relationship satisfaction and higher IP use accords with previous research (Muusses, Kerkhof, & Finkenauer, 2015; Peter & Valkenburg, 2009). It is possible that relationship discontentment could correlate with dissatisfactory sexual activity leading to increased IP use to compensate (Olmstead, Negash, Pasley, & Fincham, 2013) or used by dissatisfied people for temporary escapism from a relationship they are unhappy with (Peter & Valkenburg, 2010). Moreover, relationship dissatisfaction, in addition to lower life satisfaction, may also be a source of stress or negative emotions, prompting the dysfunctional cognitions and use of IP to alleviate these experiences, which may develop into addictive use for some people.

4.3 Mediation

For males, all of the variables in the mediation models correlated significantly, with the exception of positive expectancy of IP use and anxiety. Thus, the predictor variable (e.g., depression) correlated significantly with the mediator variable (e.g., positive or avoidance expectancy), which in turn correlated with the outcome variable (IPS score). Furthermore, the direct effect between depression, anxiety, and stress, and addictive IP use were no longer significant once IP expectancies were included in the mediator model. Theoretically, psychopathology (e.g., depression) is the diathesis and the stressor is IP (Davis, 2001). Psychopathology is associated with various maladaptive cognitions, which can diminish effective problem solving and cause psychological distress (Clark, Beck, & Stewart, 1990). Thus, psychopathology may predispose a person to addictive use of IP if it is used as a dysfunctional coping mechanism, or if this behavior receives positive or negative reinforcement by providing gratification or relief from psychological distress, or both of them, which for some people can lead to addictive IP use.

Because the direct effect between predictor and outcome variables were no longer significant once the mediators were included in the models, it is tempting to claim that this suggests that IP addiction would not develop without these dysfunctional cognitions. However, we think this would be an interpretive overreach given that the predictor variables and outcome variable correlated significantly on the bivariate level prior to mediation analysis. Moreover, we only measured three potential variables in the development and maintenance of IP addiction and there are potentially many other influential variables that were not included in our study but may be equally or more important.

For females, IP use expectancies and dysfunctional coping styles did not mediate the relationships between psychopathology, stress, and addictive IP use to the same extent as for males. Dysfunctional coping did not mediate any relationships between psychopathology, stress, and addictive IP use, while neither positive nor avoidance IP use expectancies mediated the relationship between stress and addictive IP use. Positive IP use expectancies only mediated the relationship between depression and addictive IP use. The strongest mediator effect was avoidance IP use expectancies, which mediated the relationships between depression, anxiety, and social anxiety, and addictive IP use. In fact, for both genders avoidance IP expectancies was the most consistent mediating variable, which fits with the findings of Levin et al. (2018), who also found people who view for avoidance reasons also experience more consequences. Conceivably, use of IP for avoidance could develop into a vicious cycle.

The biggest difference in the mediation analysis between males and females was that dysfunctional coping styles mediated relationships between all predictor and outcome variables for males but not for females. We decided to use a generic dysfunctional coping measure for this study because IP use has high potential for addiction (Meerkerk et al., 2006) and thus it might be used as a general dysfunction coping mechanism. For males, this appears to be the case to some extent but not for females. Hence, it could be that the measurement tool used in this study lacked sensitivity for females. Alternatively, it could be that females do not use IP as a dysfunctional coping mechanism to the same degree as males do.

Nonetheless, these findings do suggest that positive and avoidance IP use expectancies, and dysfunctional coping styles have a role in the development and maintenance in addictive IP use for males, while avoidance expectancies seem to play a role for females. Hence, these maladaptive cognitions are an area that could be targeted in psychological intervention. Cognitive-behavioral therapy (CBT) is often considered the most useful treatment for IP addiction (Short et al., 2016). However, despite the potential for aspects of CBT such as cognitive restructuring and behavior modification, a study by Orzack, Voluse, Wolf, and Hennen (2006) found that treatment seeker's IP use was unchanged following treatment, although there were noted improvements in depressive symptoms and quality of life.

Another avenue for potential treatment could focus on the avoidance IP use expectancies, particularly since we found this was a significant factor for both genders in our study. Twohig and Crosby (2010) used Acceptance and Commitment Therapy (ACT; Hayes,

Strosahl, & Wilson 2011), a treatment that focuses on reducing experiential avoidance, and found a reduction of 85% in IP use. A follow-up randomized control study by Crosby and Twohig (2016) also found impressive reductions in IP use of 93% in the ACT group compared to 21% in the waitlist control group. It should be noted that the lack of definitive conceptualization of IP addiction hampers efforts to develop treatments for it.

4.4 Gender Differences

There are stark gender differences in virtually all of the measures relating to IP use. Although some argue that socialization accounts for the differences between male and female IP use (e.g., Harper & Hodgins, 2016), we question this to some extent. Firstly, from an evolutionary perspective, males and females would have developed the same psychological mechanisms to overcome problems that did not differ based on gender, but for problems that did differ based on gender it is reasonable to assume males and females would evolve different psychological mechanisms to optimize their solutions to these problems (Malamuth, 1996). Trivers (1972) suggests that the genders have different selection pressures for reproductive success, leading to differing mating strategies. Simplistically, females are biologically constrained to bearing considerably fewer offspring in their lifetime compared to males. Reproductive success for females may be to choose a mate with good genes and who can provide resources (long-term strategy), but for males it may take the form of intercourse with many females to maximize their potential offspring (short-term strategy). Hence, because IP offers a vast number of females that are portrayed as partaking in, and available for, casual sex and exhibiting many fertility cues (Hald, 2006), it may appeal more to males than females due to the divergent evolution of the respective genders mating strategies (Malamuth, 1996).

Additionally, according to social role theory, the social environment influences gender preferences and hence more gender egalitarian societies should be characterized by attenuated gender differences (Falk & Hermle, 2018). However, recent large-scale studies have found precisely the opposite; that is, the more gender neutral the country the greater the expression of gender differences (Falk & Hermle, 2018; Giolla & Kajonius, 2019). It is conceivable that in societies where there are less restrictions on gender preferences, innate or biological preferences become more pronounced (Giolla & Kajonius, 2019). Anonymity is one of the tenets of the Triple A engine (Cooper, 1998) and enables people to express their preferences privately, arguably attenuating socialization effects. Therefore, the results we have found could be demonstrative of the biological differences between males and females in the context of IP use. We do not entirely discount the effect of socialization but the

argument that socialization is *the* reason for gender differences in IP use appears to be inadequate and we believe evolutionary and biological explanations should also be considered.

4.5 Other Findings

Tolerance and withdrawal are established processes in drug addiction but are conceptually more controversial for behavioral addictions (Starcevic, 2012). Although there is evidence of tolerance and withdrawal in Internet gaming addiction (Kuss, 2013) Kafka (2010) was unable to find evidence for either when he proposed criteria for Hypersexual Disorder.

According to positive and negative reinforcement models, one reason drugs are taken is to achieve a state of pleasant affect which are opposed by adaptive mechanisms in an attempt to re-establish equilibrium, resulting in tolerance and withdrawal states in the absence of the drug, leading to ongoing drug use to avoid unpleasant withdrawal states (Koob, Caine, Parsons, Markou, Weiss, 1997).

In the current study, there was a strong association between addictive IP use and both positive and avoidance IP use expectancies (which measures positive and negative reinforcement respectively; Brand et al., 2014). We speculate that these associations could be evidence of addictive reinforcement mechanisms in IP users. Conceivably, frequent IP use leads to development of tolerance, which perpetuates IP use to avoid aversive affective states. There were also strong associations between addictive IP use and number of IP sessions per month and minutes used per month, and moderate associations between addictive IP use and greater frequency of use and using more extreme content. Harper and Hodgins (2016) found that daily or more frequent use coincided with more addictive IP use and, taken with our finding of use of more extreme content, could speculatively be interpreted as evidence of tolerance, insofar as the users having to use greater amounts and more extreme IP to achieve the desired effect. This is consistent with neuroscientific evidence which suggests that frequent IP use may desensitize users leading them to spend more time searching for novel stimuli and more extreme content (Kühn, & Gallinat, 2014).

Another noteworthy finding was that the relationship between earlier first exposure to IP and greater addictive IP use, IP use expectancies, and dysfunctional coping. Earlier onset of drug use is also associated with higher likelihood of later addictive drug use, although the reasons for this are unknown (Grant & Dawson, 1998). Based on our findings, it is conceivable that a young person who discovers substances or behaviors that provide instant gratification or relief from adverse psychological states may develop maladaptive cognitive

mechanisms that lead to further use as a dysfunctional coping mechanism that becomes behaviorally ingrained as they mature. Although, this is speculative it is an area that is worthy of further investigation.

4.6 Strengths and Limitations

Many previous studies used student samples (e.g., Harper & Hodgins, 2016), making the results less generalizable. To attempt to overcome this, in addition to students, we also recruited people from the general public via social media and Internet forums. We also analyzed males and females separately, something that Carroll et al. (2008) note is a limitation of previous research in the area of IP, which has led to inconsistencies in the frequency and correlates of IP use. Carroll et al. also highlight that usage patterns in previous research has limited utility because it has been measured using response codes such as “never” “seldom” “sometimes” “often”. We asked respondents to give an average estimate of number of IP sessions per month as well as average duration of IP session to provide a comprehensive picture of usage patterns.

This study has some limitations. Firstly, it was a cross-sectional design, meaning that neither temporal order nor causality can be claimed. Nonetheless, the data, by-and-large, do fit the proposed theoretical model, at least for males. Although the total sample was $N=238$, we analyzed the data along gender lines and this essentially resulted in halving the sample, meaning that a full model using all of the mediator variables (i.e., positive and avoidance IP use expectancies and dysfunctional coping) would have been too complex for the sample size. Secondly, we used self-report measures and hence relied on the participants answering genuinely. IP use is a deeply personal issue and could potentially result in respondents providing inaccurate answers, thus decreasing the reliability of the findings. We did try to address this by emphasizing the confidential nature of the study, which can be useful for controversial topics (Rains, 2013). However, all of the correlations in the study were in the expected direction, except for self-esteem and the IPS, and the internal reliability was high for all measures suggesting that the respondents answered consistently. We also used participants from the general community and students, rather than a clinical population.

4.7 Future Research

The current study suggests that cognitive mechanisms may play an important role in the development and maintenance of IP addiction. However, future research could use a longitudinal design to uncover temporal order and possible causality of the measured variables. Further research could also focus on clinical samples, since this is where the

development of potential treatments will be most salient. It would be interesting to discover whether the gender differences we found diminish in clinical samples.

4.8 Conclusion

We provided correlates to IP addiction measured using the IPS, a scale that was a modified version of the Internet Gaming Disorder. We did this because should the APA include further behavioral addictions, in addition to Gambling Disorder, in future editions of the DSM they may focus on criteria that these conditions have in common. With the exception of self-esteem, the correlations were in the directions expected and of medium effect size in general.

We also applied a cognitive-behavioral model of Internet addiction to IP addiction. We found that psychopathology and stress were correlated with higher scores on the IPS and for males these were generally mediated by positive and avoidance IP use expectancies and dysfunctional coping styles. For females, generally psychopathology was mediated by avoidance IP use expectancies but not by positive IP use expectancies or dysfunctional coping styles. We suggest that further research should be undertaken on clinical samples that address cognitions relating to IP use as an avoidance cognitive mechanism for both genders and positive IP use expectancies and dysfunctional coping styles for males.

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Appendix A

Table 1.

Means, Standard Deviations, Cronbach's α , t-Values for Differences between Genders, and Cohen's d for Psychopathology Scales, Addiction Inventories, Relationship, Self-Esteem, Life Satisfaction Scales

| Scale Name | Total (<i>SD</i>) | Cronbach's α | Male (<i>SD</i>) | Female (<i>SD</i>) | $t(df)$ | Cohen's d |
|-------------|------------------------|------------------------|-----------------------|-------------------------|-------------------|----------------|
| DASS Dep | 6.35 (4.83) | .92 | 6.15 (4.84) | 6.55 (4.84) | .64 (236) | .08 |
| DASS Anx | 4.21 (3.57) | .81 | 3.58 (3.01) | 4.86 (3.98) | 2.80* (217.8) | .36 |
| DASS Stress | 7.31 (3.95) | .84 | 6.83 (3.82) | 7.81 (4.03) | 1.93 (236) | .25 |
| SIAS | 17.8 (10.58) | .91 | 17.5 (10.12) | 18.2 (11.06) | .55 (236) | .07 |
| AUDIT | 8.13 (6.23) | .87 | 9.75 (7.20) | 6.26 (4.22) | 3.93** (150.2) | .59 |
| RAS | 28.7 (5.36) | .86 | 28.3 (5.19) | 29.0 (5.53) | .66 (110) | .13 |
| IGDT-10 | 6.69 (4.37) | .85 | 7.14 (4.56) | 5.65 (3.62) | 1.76 (119) | .36 |
| RSE | 22.5 (6.59) | .93 | 21.7 (6.68) | 23.3 (6.45) | 1.79 (236) | .23 |
| Life Satis | 19.1 (8.97) | .93 | 18.6 (9.15) | 19.6 (8.79) | .85 (236) | .11 |

Note. * $p < .05$, ** $p < .001$; DASS Dep = DASS 21 Depression scale; DASS Anx = DASS 21 Anxiety scale; DASS Stress = DASS 21 Stress Scale; SIAS = Social Interaction Anxiety Scale Short-Form; AUDIT = Alcohol Use Disorder Identification Test; RAS = Relationship Assessment Scale; IGDT-10 = Internet Gaming Disorder Test; RSE = Rosenberg Self-Esteem Scale

Appendix B

Table 2.

Means, Standard Deviations, Cronbach's α , t-Values for Differences between Genders, and Cohen's d for IP Related Scales and Questions

| Scale Name | Total (SD) | Cronbach's α | Male (SD) | Female (SD) | $t(df)$ | Cohen's d |
|-------------------|------------------|------------------------|------------------|------------------|-------------------|----------------|
| IPS | 21.8 (21.4) | .93 | 31.2 (23.5) | 12.2 (13.5) | 7.64** (190.3) | .99 |
| Pos IP Expect | 16.6 (9.13) | .92 | 20.2 (6.72) | 12.9 (9.76) | 6.79** (207.2) | .88 |
| Avoid IP Expect | 6.97 (7.25) | .84 | 9.79 (7.46) | 4.10 (5.78) | 6.58** (223.9) | .85 |
| COPE Denial | 2.48 (3.25) | .83 | 3.09 (3.59) | 1.86 (2.74) | 2.99* (222.4) | .39 |
| COPE Sub Use | 2.63 (4.21) | .96 | 3.91 (4.89) | 1.33 (2.87) | 4.97** (193.6) | .64 |
| COPE Behave | 2.59 (3.59) | .93 | 3.04 (3.96) | 2.13 (3.11) | 1.98* (225.1) | .26 |
| Sessions/Month | 11.5 (12.7) | - | 18.2 (13.4) | 4.69 (7.21) | 9.69** (182.9) | 1.25 |
| Session Duration | 22.8 (23.0) | - | 28.8 (25.1) | 16.6 (18.8) | 4.24** (236) | .55 |
| IP First Exposure | 15.1 (5.43) | - | 14.5 (5.17) | 15.8 (5.64) | 1.87 (229) | .24 |
| Frequency | 3.8 (1.49) | - | 4.07 (1.53) | 3.53 (1.41) | 2.79* (236) | .37 |
| Extremity | 4.42 (1.26) | - | 4.58 (1.32) | 4.25 (1.19) | 2.03* (234.1) | .26 |
| Mins per Month | 341.3 (510.1) | - | 542.9 (579.4) | 136.3 (318.6) | 6.72** (185.6) | .87 |

Note. * $p < .05$, ** $p < .001$; IPS = Internet Pornography Scale; Pos IP Expect = Positive IP use expectancies; Avoid IP Expect = Avoidance IP use expectancies; COPE Sub Use = COPE substance misuse; COPE behave = COPE Behavioral disengagement; Sessions/Month = Average number of IP session per month; Session Duration (Mins) = Average IP session duration in minutes; IP First Exposure = Age at which first exposed to IP; Frequency = how much IP use has changed in the last year where 0=decreased a lot and 7=increased a lot; Extremity = how much the Internet Pornography had changed regarding how extreme the content searched is in the last year where 0=much less extreme and 7=much more extreme; Mins per Month = Average mins of IP used per month

Appendix C

Table 3.

Pearson Correlations Between Internet Pornography Scale (sum score), Questionnaires Administered, and Pornography Use Related Questions.

| | 1 IPS | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|--------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------------|------------|
| 2 DASS Depression | .39 | | | | | | | | | | | | | | | |
| 3 DASS Anxiety | .13 | .56 | | | | | | | | | | | | | | |
| 4 DASS Stress | .35 | .70 | .67 | | | | | | | | | | | | | |
| 5 SIAS-SF | .39 | .63 | .45 | .59 | | | | | | | | | | | | |
| 6 RAS | -.34 | -.53 | -.21 | -.30 | -.34 | | | | | | | | | | | |
| 7 Positive Expect | .61 | .19 | .01 | .14 | .21 | -.14 | | | | | | | | | | |
| 8 Avoidance Expect | .82 | .40 | .17 | .34 | .38 | -.38 | .58 | | | | | | | | | |
| 9 COPE Denial | .48 | .37 | .24 | .33 | .36 | -.26 | .18 | .45 | | | | | | | | |
| 10 COPE Sub Use | .47 | .33 | .04 | .34 | .31 | -.14 | .27 | .46 | .47 | | | | | | | |
| 11 COPE Disengage | .56 | .60 | .26 | .42 | .48 | -.30 | .24 | .56 | .61 | .51 | | | | | | |
| 12 AUDIT | .56 | .35 | .08 | .42 | .30 | -.29 | .25 | .44 | .54 | .71 | .49 | | | | | |
| 13 IGDT-10 | .53 | .39 | .14 | .45 | .46 | -.09 | .27 | .43 | .43 | .50 | .44 | .53 | | | | |
| 14 First Exposure | -.34 | -.29 | -.18 | -.25 | -.28 | .15 | -.30 | -.28 | -.18 | -.24 | -.19 | -.40 | -.43 | | | |
| 15 Sessions/Month | .67 | .17 | -.03 | .10 | .22 | -.28 | .52 | .55 | .25 | .28 | .26 | .41 | .27 | -.36 | | |
| 16 Duration/Mins | .48 | .26 | .01 | .18 | .20 | .00 | .47 | .37 | .26 | .21 | .34 | .25 | .31 | -.11 | .27 | |
| 17 Mins/Month | .64 | .24 | -.03 | .20 | .24 | -.14 | .48 | .50 | .33 | .35 | .35 | .50 | .39 | -.28 | .71 | .72 |

Note. **Bold** $p < .05$. IPS = Internet Pornography Scale using a modified version of the DSM Internet Gaming Disorder criteria; DASS = DASS 21 separated into the three dimensions of Depression, Anxiety, and Stress; SIAS-SF = Social Interaction Anxiety Scale Short Form; RAS = Relationship Assessment Scale; Positive Expect = Positive IP Use Expectancy; Avoidance Expect = Avoidance IP Use Expectancy; COPE dimensions Denial, Substance Use, and Behavioral Disengagement; AUDIT = Alcohol Use Disorders Identification Test; IGDT-10 = Internet Gaming Disorder Test; First Exposure = age when first exposed to Internet pornography; Sessions/Month = number of sessions of Internet Pornography used per month; Duration/Mins = average duration in minutes per session of Internet Pornography use; Mins/Month = sum of sessions per month multiplied by duration in minutes.

Appendix D

Table 4.
Pearson Correlations Between Internet Pornography Scale (sum score) and Demographics and Other.

| | 1 IPS | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-----------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------------|
| 2 Age | -.11 | | | | | | | | |
| 3 Gender | -.44 | -.28 | | | | | | | |
| 4 Relationship Status | -.17 | .42 | -.00 | | | | | | |
| 5 Employment Status | -.03 | .54 | -.24 | .38 | | | | | |
| 6 Religion | -.08 | .04 | .10 | .09 | -.01 | | | | |
| 7 Self-esteem | .34 | -.22 | .12 | -.16 | -.29 | -.13 | | | |
| 8 Life Satisfaction | -.43 | .21 | .06 | .27 | .22 | .16 | -.74 | | |
| 9 Frequency Change | .36 | .00 | -.18 | .00 | .01 | -.24 | .10 | -.13 | |
| 10 Extremity Change | .36 | .03 | -.13 | .01 | .05 | -.14 | .17 | -.15 | .36 |

Note. **Bold** $p < .05$. IPS = Internet Pornography Scale using a modified version of the DSM Internet Gaming Disorder criteria; Gender male = 0, female = 1; relationships status 0 = single, 1 = dating, 2 = serious relationship; Employment status 0 = unemployed, 1 = causal/part-time, 2 = fulltime employment; religion refers to importance of religion where 1 = not important at all and 7 = extremely important; Self-esteem = Self-Esteem Scale; Life Satisfaction = Satisfaction with Life Scale; Frequency Change = how much Internet Pornography use has changed in the last year where 0=decreased a lot and 7=increased a lot; Extremity Change = how much the Internet Pornography had changed regarding how extreme the content searched is in the last year where 0=much less extreme and 7=much more extreme.

Appendix E

Table 5.

Mediation Analysis for Psychopathology, Stress, and IPS Scores Mediated by Positive and Avoidance IP Use Expectancies for Males.

| <i>X</i> | Mediator Variable (<i>M</i>) | | | IPS (<i>Y</i>) | | |
|------------|---|----------------------|-----------|-------------------------------|----------------------|------------|
| | Pathway (Mediator Name) | Coeff. (<i>SE</i>) | 95% CI | Pathway ^a | Coeff. (<i>SE</i>) | 95% CI |
| Depression | a ₁ (Positive Expectancies) | .35 (.12) | .11, .60 | c' | .61 (.32) | -.03, 1.24 |
| | | | | b ₁ | .54 (.21) | .13, .95 |
| | a ₂ (Avoidance Expectancies) | .96 (.11) | .74, 1.18 | b ₂ | 2.10 (.23) | 1.64, 2.55 |
| | | | | a ₁ b ₁ | .19 (.09) | .04, .38 |
| Anxiety | a ₁ (Positive Expectancies) | .15 (.21) | -.26, .55 | a ₂ b ₂ | 2.01 (.39) | 1.30, 2.80 |
| | | | | c' | .47 (.44) | -.41, 1.35 |
| | a ₂ (Avoidance Expectancies) | .94 (.21) | .52, 1.36 | b ₁ | .54 (.21) | .13, .96 |
| | | | | b ₂ | 2.27 (.20) | 1.86, 2.67 |
| Stress | a ₁ (Positive Expectancies) | .52 (.15) | .22, .83 | a ₁ b ₁ | .08 (.11) | -.13, .32 |
| | | | | c' | .70 (.41) | -.12, 1.52 |
| | a ₂ (Avoidance Expectancies) | 1.26 (.14) | .98, 1.53 | b ₂ | 2.12 (.23) | .166, 2.58 |
| | | | | a ₁ b ₁ | .27 (.12) | .08, .54 |
| SIAS | a ₁ (Positive Expectancies) | .22 (.06) | .10, .33 | a ₂ b ₂ | 2.66 (.53) | 1.66, 3.73 |
| | | | | c' | .40 (.14) | .12, .68 |
| | a ₂ (Avoidance Expectancies) | .41 (.06) | .30, .52 | b ₂ | 2.10 (.21) | 1.66, 2.48 |
| | | | | a ₁ b ₁ | .10 (.04) | .03, .20 |
| | | | | a ₂ b ₂ | .85 (.14) | .57, 1.13 |

Note. Depression, Anxiety, and Stress were measured using the DASS-21; SIAS SF = Social Interaction Anxiety Scale Short Form

^a See Figure 1 for pathway designations

Appendix F

Table 6.

Mediation Analysis for Psychopathology, Stress, and IPS Scores Mediated by Positive and Avoidance IP Use Expectancies for Females.

| <i>X</i> | Mediator Variable (<i>M</i>) | | | IPS (<i>Y</i>) | | |
|------------|---|----------------------|-----------|-------------------------------|----------------------|-----------|
| | Pathway (Mediator Name) | Coeff. (<i>SE</i>) | 95% CI | Pathway | Coeff. (<i>SE</i>) | 95% CI |
| Depression | a ₁ (Positive Expectancies) | .42 (.18) | .06, .78 | c' | .23 (.17) | -.10, .56 |
| | | | | b ₁ | .55 (.10) | .36, .74 |
| | a ₂ (Avoidance Expectancies) | .30 (.11) | .09, .51 | b ₂ | 1.08 (.17) | .75, 1.41 |
| | | | | a ₁ b ₁ | .23 (.12) | .02, .50 |
| Anxiety | a ₁ (Positive Expectancies) | .26 (.23) | -.19, .71 | a ₂ b ₂ | .32 (.15) | .08, .67 |
| | | | | c' | .11 (.20) | -.29, .50 |
| | a ₂ (Avoidance Expectancies) | .25 (.13) | -.01, .52 | b ₁ | .56 (.10) | .37, .75 |
| | | | | b ₂ | 1.10 (.17) | .77, 1.43 |
| Stress | a ₁ (Positive Expectancies) | .37 (.22) | -.07, .81 | a ₁ b ₁ | .15 (.14) | -.13, .44 |
| | | | | a ₂ b ₂ | .28 (.16) | .02, .65 |
| | a ₂ (Avoidance Expectancies) | .24 (.13) | -.02, .51 | c' | .52 (.19) | .14, .90 |
| | | | | b ₁ | .54 (.09) | .36, .73 |
| SIAS | a ₁ (Positive Expectancies) | .17 (.08) | .01, .33 | b ₂ | 1.07 (.16) | .75, 1.39 |
| | | | | a ₁ b ₁ | .20 (.14) | -.07, .51 |
| | a ₂ (Avoidance Expectancies) | .15 (.05) | .06, .25 | a ₂ b ₂ | .26 (.17) | -.01, .63 |
| | | | | c' | .10 (.07) | -.05, .24 |
| | | | | b ₁ | .56 (.10) | .37, .75 |
| | | | | a ₁ b ₁ | .09 (.05) | .00, .21 |
| | | | | a ₂ b ₂ | .16 (.07) | .05, .31 |

Note. Depression, Anxiety, and Stress were measured using the DASS-21; SIAS SF = Social Interaction Anxiety Scale Short Form

Appendix G

Table 7.

Mediation Analysis for Psychopathology, Stress, and IPS Scores Mediated by Dysfunctional Coping.

| Gender | <i>X</i> | Pathway | COPE (<i>M</i>) | | Pathway ^a | IPS (<i>Y</i>) | |
|--------|------------|---------|----------------------|------------|----------------------|----------------------|------------|
| | | | Coeff. (<i>SE</i>) | 95% CI | | Coeff. (<i>SE</i>) | 95% CI |
| Male | Depression | a | 1.48 (.16) | 1.17, 1.79 | c' | 1.12 (.43) | .28, 1.96 |
| | | | | | b | 1.14 (.19) | .76, 1.51 |
| | | | | | ab | 1.69 (.34) | 1.06, 2.36 |
| | Anxiety | a | .86 (.32) | .21, 1.50 | c' | 1.51 (.53) | .46, 2.55 |
| | | | | | b | 1.37 (.15) | 1.08, 1.65 |
| | | | | | ab | 1.17 (.40) | .36, 1.94 |
| | Stress | a | 1.81 (.20) | 1.41, 2.21 | c' | 1.65 (.52) | .62, 2.67 |
| | | | | | b | 1.10 (.18) | .74, 1.46 |
| | | | | | ab | 1.99 (.44) | 1.13, 2.88 |
| | SIAS | a | .61 (.08) | .45, .78 | c' | .67 (.18) | .31, 1.03 |
| | | | | | b | 1.11 (.17) | .78, 1.44 |
| | | | | | ab | .68 (.14) | .43, .97 |
| Female | Depression | a | .51 (.11) | .30, .72 | c' | .66 (.27) | .12, 1.20 |
| | | | | | b | .25 (.22) | -.18, .67 |
| | | | | | ab | .13 (.11) | -.09, .36 |
| | Anxiety | a | .54 (.13) | .28, .80 | c' | .33 (.33) | -.33, .98 |
| | | | | | b | .38 (.22) | -.04, .81 |
| | | | | | ab | .21 (.12) | -.01, .48 |
| | Stress | a | .48 (.13) | .22, .74 | c' | .85 (.31) | .23, 1.47 |
| | | | | | b | .28 (.21) | -.13, .69 |
| | | | | | ab | .13 (.10) | -.06, .34 |

| | | | | | | |
|------|---|-----------|----------|----|-----------|-----------|
| SIAS | a | .23 (.05) | .14, .32 | c' | .30 (.12) | .07, .54 |
| | | | | b | .23 (.22) | -.20, .66 |
| | | | | ab | .05 (.05) | -.05, .15 |

Note. Depression, Anxiety, and Stress were measured using the DASS-21; SIAS SF = Social Interaction Anxiety Scale Short Form

^a See Figure 3 for pathway designations

Appendix H

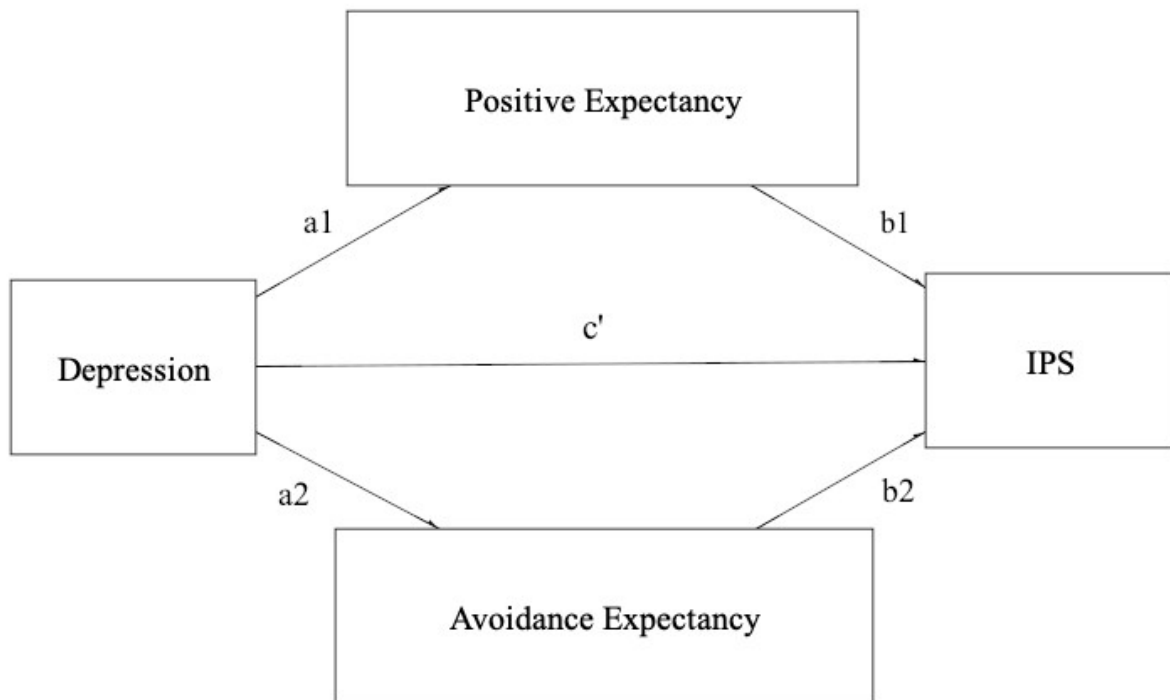


Figure 1. Example conceptual mediation model for Hypothesis 3. Depression refers to Depression as measured by the DASS-21, Positive Expectancy and Negative Expectancy refer to IP use expectancy as measured by the Internet Pornography Use Expectancies Scale, and IPS refers to IP addiction as measured by the Adapted Internet Gaming Disorder DSM-5 Questions to fit IP Addiction.

Appendix I

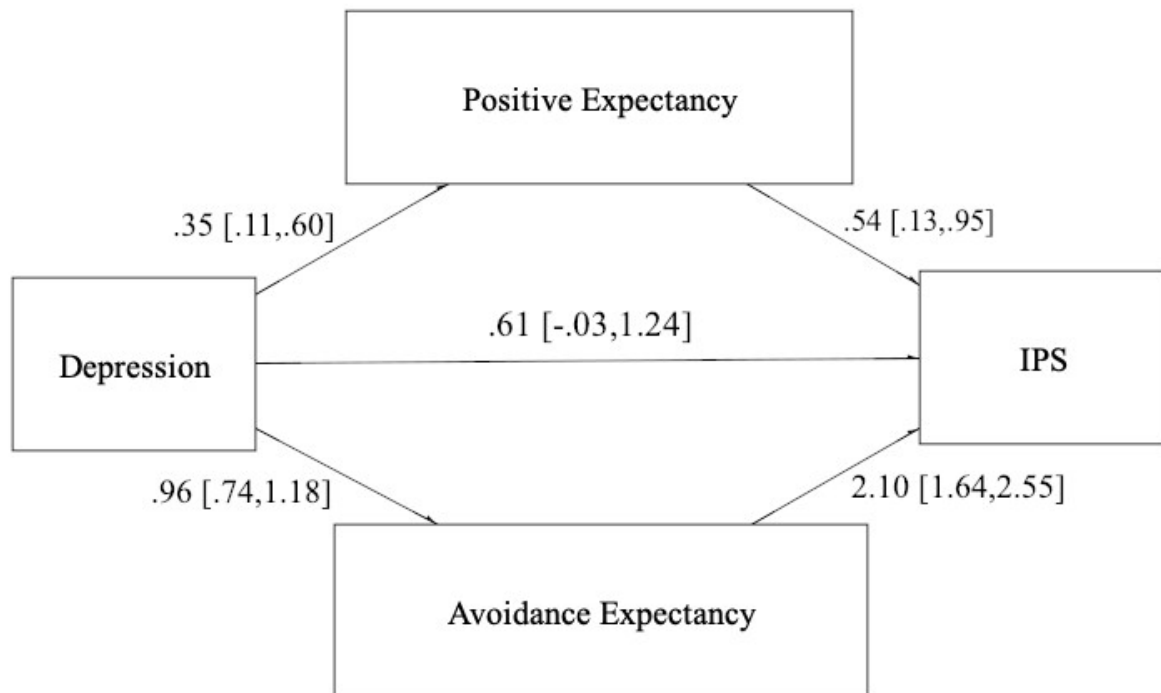


Figure 2. Statistical mediation model for Hypothesis 3 (male data shown). Depression refers to Depression as measured by the DASS-21, Positive Expectancy and Negative Expectancy refer to IP use expectancy as measured by the Internet Pornography Use Expectancies Scale, and IPS refers to IP addiction as measured by the Adapted Internet Gaming Disorder DSM-5 Questions to fit IP Addiction.

Appendix J

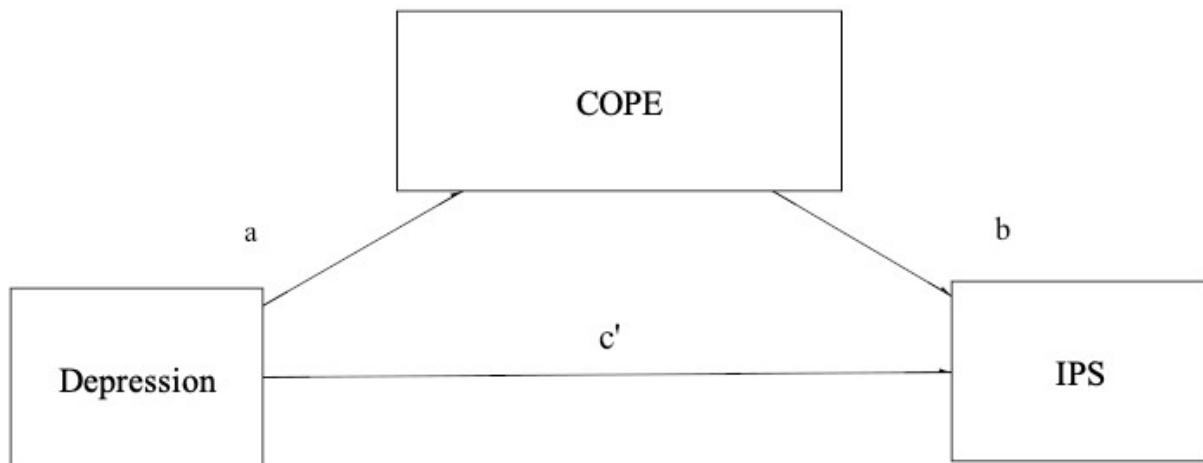


Figure 3. Example conceptual mediation model for Hypothesis 4. Depression refers to Depression as measured by the DASS-21, COPE refers to dysfunctional coping as measured by the Brief COPE, and IPS refers to IP addiction as measured by the Adapted Internet Gaming Disorder DSM-5 Questions to fit IP Addiction.

Appendix K

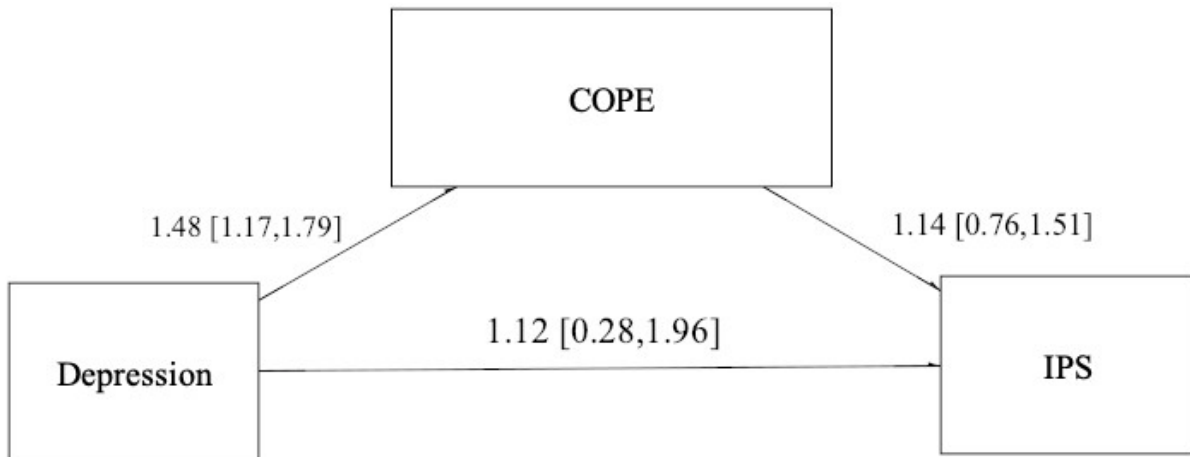


Figure 4. Statistical mediation model for Hypothesis 4 (male data shown). Depression refers to Depression as measured by the Dass-21, COPE refers to dysfunctional coping as measured by the Brief COPE, and IPS refers to IP addiction as measured by the Adapted Internet Gaming Disorder DSM-5 Questions to fit IP Addiction. Unstandardized path coefficients are shown, 95% Cis in brackets.

Appendix L

Link to instructions for potential publication journal

<https://www.tandfonline.com/action/authorSubmission?show=instructions&journalCode=usac20#words>