Sex, Drugs, and Science: A Review of the Scientific Literature For and Against an Addiction Model for Sexual Behavior and Pornography Use

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The word "addiction" has been falling out of favor for some time in physical and mental health communities (APA, 2013; Carlson & Birkett, 2017; Volkow & Li, 2005). Not only do many professionals find it to be stigmatizing and shame-inducing, there is also some collective concern about the damaging effects of overusing the term and the oft-ineffectiveness of traditional addiction treatment models (Carlson & Birkett, 2017; Ley, Prause, & Finn, 2014). Not every expert agrees with this assessment, however, as is evidenced by the myriad treatment centers, programs, and robust lines of scientific research all dedicated to understanding and eradicating various forms of "addiction" (i.e., chronic substance abuse issues and compulsive behaviors). After scandals like the sexual abuse allegations against public figure Harvey Weinstein (BBC, 2018) and sweeping social movements like #MeToo and #TimesUp (Langone, 2018), people are looking to experts for answers and constructs like sex and/or pornography addiction have been thrown into the global spotlight. Addiction specialists, psychologists, sexologists, neuroscientists and health professionals now find themselves on two sides of a growing debate: can a person become addicted to internet pornography (visual sexual stimuli – VSS) or sexual behavior? I will attempt to discover a compelling answer to this question by providing a brief overview of the current neuroscientific model for addiction, followed by a review of prominent empirical literature on both sides of this sex/pornography addiction debate.

Neuroscience of Addiction

The foundations of addiction research have been built on explorations of the causes and effects of chronic substance abuse (Koob, Sanna, & Bloom, 1998; Volkow & Li, 2005). Behavioral addiction models and addiction treatment and recovery models have almost entirely

been built on this foundation and some of these models do include theories about sex and porn addiction. Much of the research and theories about sex and porn addiction have been attempts to map compulsive sexual behavior and problematic VSS-use onto a substance addiction model and then subsequently employ an addiction recovery plan when individuals seek treatment. Scientists are at odds regarding the validity of this approach and the interpretations of the available data. The current neuroscientific model of addiction outlines three key elements to addiction, which are often described as cyclical in nature: compulsion, negative emotionality, and craving (Koob et al., 1998; Love, Laier, Brand, Hatch, & Hajela, 2015; Volkow & Li, 2005).

The first component, compulsion, is sometimes also referred to as binging or seeking/using behavior (Koob et al., 1998; Volkow & Li, 2005). This first stage of addiction is characterized by reinforcement (Carlson & Birkett, 2017; Koob et al., 1998; Volkow & Li, 2005). The neural systems implicated in reinforcement are primarily those involved with release and regulation of dopamine, specifically the mesocorticolimbic dopamine pathways, also called the "reward pathways". Experiences we perceive to be positive or rewarding trigger a release of dopamine in the ventral tegmental area (VTA) which then projects to the nucleus accumbens (NAC), the frontal cortex, the amygdala, and/or the hippocampus (Carlson & Birkett, 2017; Koob et al., 1998; Love et al, 2015; Volkow & Li, 2005). As a result of this dopaminergic activity, experiences we perceive to be rewarding have the power to impact our emotions, cognition, learning and memory, behavior, affect, and much more. Most drugs of abuse affect the reuptake or release of dopamine, resulting in a flood of dopamine in the system and an inhibition of the natural dopamine system responses. This flood of dopamine is experienced as a positive association with the activity or substance that triggered it, which can contribute to learned (and

eventually, potentially, habitual) behaviors (Koob et al., 1998; Love et al, 2015; Volkow & Li, 2005).

Self-administration of a substance is one of the characteristics of its reinforcing qualities (Love et al, 2015; Volkow & Li, 2005). In laboratory experiments rats have been shown to continue to press a lever that delivers a dopamine hit (via substance or brain stimulation) over and over, even in the face of adverse consequences up to and including starvation and death (Koob et al., 1998; Volkow & Li, 2005). This self-administration is exemplary not only of compulsive taking behavior but also compulsive seeking behavior, which researchers posit is just as important in contributing to the development of dependence, if not more so (Koob et al., 1998; Love et al, 2015; Volkow & Li, 2005). Social and contextual factors also create habitual behaviors which contribute to dependence (Love et al, 2015; Volkow & Li, 2005).

The second component of this addiction model is negative emotionality or negative affect. Chronic substance abuse can result in physiological changes such as brain adaptions that contribute to the dependency that is so characteristic of addiction. For example, when the substance is no longer present activation of the amygdala triggers fear and pain responses which result in prominent negative emotionality, physical pain, and other effects; collectively referred to as withdrawal (Koob et al., 1998; Love et al, 2015; Volkow & Li, 2005). Frequency plays a major role in this process (Koob et al., 1998; Love et al, 2015). What starts as occasional or recreational use becomes repeated use which becomes chronic use and/or abuse (addiction). The goal of addiction research is to understand the physiological, social, and environmental factors that contribute to loss of behavioral control and compulsive seeking/taking (i.e., how recreational use becomes chronic abuse) for some people but not others (Koob et al., 1998). Experiencing this negative emotionality demands a search for relief; relief which comes from repeated use. This is

even more prominent in cases where substance use provides instant or near-instant gratification (Carlson & Birkett, 2017). There is, then, subsequent return of negative emotionality when use ceases, and repeated use becomes chronic abuse (Carlson & Birkett, 2017; Koob et al., 1998; Love et al, 2015; Volkow & Li, 2005). Repeated use also results in increased reward threshold. It takes more of the substance to achieve the same "reward" affects and as tolerance increases, use increases (Koob et al., 1998; Love et al, 2015; Volkow & Li, 2005).

The third component of this addiction model is craving, also referred to as obsession or preoccupation (Koob et al., 1998; Love et al, 2015; Volkow & Li, 2005), although craving is much more than a mental hyper-focus. Substances of abuse often provide a far more powerful activation of dopamine systems (i.e., greater "reward" payout) than what is provided by natural experiences, particularly after prolonged use has interfered with or impaired typical neural functioning. These neural impairments can include damage to the prefrontal cortex (PFC) even beyond the mesocorticolimbic dopamine pathways, which affects self-regulation, self-control, planning, and other functions. All of this contributes to a feeling of intense craving and also contributes to vulnerability to relapse, which is what characterizes addiction as a cyclical and, in many cases, lifelong challenge (Koob et al., 1998; Love et al., 2015; Volkow & Li, 2005).

Sex and Porn: Addiction or Something Else?

Proponents of an addiction model for sex and porn have presented evidence that VSS and sexual behavior both trigger the same kinds of brain activity in dopamine pathways that are activated by substances of abuse (Frohmader, Wiskerke, Wise, Lehman, & Coolen, 2011; Pitchers et al., 2013). Like most neuroscientific addiction research, this research has largely been conducted in laboratory animals. Love and colleagues (2015) conducted a review of research on myriad addictive behaviors that included internet addiction and internet porn addiction –

focusing on problematic and compulsive VSS-use and sexual acting out. They provide a framework for the application of an addiction model beyond substance abuse and to the inclusion of some behaviors, citing the inclusion of addictive behaviors on the part of the American Society of Addiction Medicine as early as 2011 (Love et al., 2015). They also note that the most current edition of the Diagnostic and Statistical Manual (DSM-5; APA, 2013) includes sections on internet gambling and other "Non-Substance-Related Disorders", although the DSM-5 does not include porn or sex among them. Love and colleagues (2015) outline several emergent patterns in the literature that favor mapping compulsive sexual behavior and porn use onto a traditional addiction model, one of the most prominent being unparalleled novelty (Love et al., 2015; Park et al., 2016).

Though VSS has been around as long as humanity, humanity's increased access to the internet has also lead to increasingly accessible VSS. VSS is, in many cases, free and instantly accessible, and the variety and diversity of available content are limited only by the imagination. Some researchers argue that this type of limitless novelty conditions human sexual arousal in a way that cannot be matched by naturally occurring experiences, making it a ripe environment for the onset of chronic use and addiction (Park et al., 2016). In fact, as self-identified “chronic” porn users flock to therapists and physicians with complaints of diminished libido and diminished erectile functioning following prolonged porn use, porn-induced erectile and sexual dysfunction (PIED) has become a growing priority for healthcare providers and an increasingly prominent focus of research (Park et al., 2016).

Scientists have also explored neural mechanisms at work in chronic porn use and sexual behavior. Researchers (Frohmader et al., 2011; Pitchers et al., 2013) found that substance abuse in lab rats contributed to increases in sexual behavior and apparent sexual desire. Frohmader et

al. (2011) gave methamphetamine to male rats and then examined their brain function and sexual behavior. They started by observing mating behaviors in sober rats over a number of trials – some rats mated, some did not. Then they broke the rats up into groups: a control group received saline injections and other groups received injections of methamphetamine that varied in dosage strength. What they found was neural activity in the mesolimbic system in the brain of the rats as both the result of sexual activity and methamphetamine use. They reported a statistically significant main effect for sexual behavior, a main effect for methamphetamine use, and an interaction between the two (Frohmader et al., 2011). Another study (Pitchers et al., 2013), conducted similarly, also showed a connection between neural systems that are active with natural reward (sex) and drug reward (in this case amphetamine). Pitchers et al. (2013), examined upregulation of the transcription factor ΔFosB. Pitchers et al. (2013) demonstrated that sexual experiences followed by a period of abstinence increased dendritic spines in the NAC, specifically long-lasting accumulation of ΔFosB. The NAC receives dopaminergic messages from the VTA and is part of what scientists think of as the brain's reward circuitry. ΔFosB accumulates and increases cravings and has been associated with addictive and compulsive behavior (Nestler, Barrot, & Self, 2001). Pitchers et al. (2013), also demonstrated that sexual cravings – even after a period of abstinence – were relieved by low-dose amphetamine use and vice versa. They called this "cross-sensitization." They suggested that, at the very least, loss of natural reward (like mating behavior) can make someone more susceptible to drug use and subsequent addiction.

In response to this research (and other similar studies), some researchers have offered compelling counterarguments. Steele, Staley, Fong, & Prause (2013) investigated the scientific validity of the popularly-held notion that individuals who have difficulty downregulating their

sexual desire – specifically viewing VSS – have a "sex addiction." Their participants were a group of 53 individuals who had complained about their use of VSS (self-diagnosed porn addicts). They showed those individuals various types of visual stimuli (emotional, sexual, neutral, etc.) and monitored neural activity on an EEG. They also asked participants to complete various measures of porn use, sexual compulsivity, sexual desire, and sexual behavior. They determined that the individuals in their participant group varied in terms of sexual desire and those on the higher end were termed "hypersexual". Instead of showing desensitization and increased tolerance (i.e., decreased EEG electrical response) to VSS, as would be expected if VSS-use followed the same addiction model as substance use, all participants showed increased neural activity in response to the VSS in the experiment, even the "hypersexual" participants. This, argues Steele et al. (2013), suggests that we might be better off reconsidering common assumptions that "hypersexuality" is indicative of an "addiction" to sex and porn.

Researchers have also provided evidence that, unlike chronic substance abuse, behavioral addictions (including porn and sex) are often episodic in nature, rather than lifelong (Konkolÿ Thege, Woodin, Hodgins, & Williams, 2015). Konkolÿ Thege and colleagues (2015) conducted a 5-year longitudinal study of the natural course of myriad behavioral addictions. They found that the vast majority of people reported problematic, obsessive, or intrusive behaviors for a period of time, but that this did not last or become cyclical and eventually individuals were able to return to comfortable functioning and what they felt was a healthy or non-intrusive relationship with the previously compulsive behavior (Konkolÿ Thege et al., 2015). This is inconsistent with the cravings, withdrawal, and relapse characteristics of the addiction model.

The notion of porn-induced erectile and sexual dysfunction has also been investigated and challenged by some clinicians and researchers (Ley at al., 2014). Ley and colleagues (2014)

posit that use of VSS and subsequent neural and psychological changes as a result of VSS-use fail to meet the criteria for addiction. Ley and colleagues (2014) suggest an interpretation of the literature that is different from the views of their pro-addiction counterparts. They suggest that changes in sexual functioning reported by some users constitute classically-conditioned, learned behaviors but that not only can this learned behavior become unlearned or refocused, this is not necessarily a negative outcome, nor is it enough to call the behavior "addictive" (Ley et al., 2014). Instead, they refer to what they call the "positive effects of VSS-use" (pg. 2) including but not limited to increases in real-life sexual variety, improved individual and social attitudes toward sexual pleasure and variance, and a relief-providing outlet for illegal or harmful sexual fantasies that should not be acted upon but are present nonetheless (Ley et al., 2014). They also cite the failures of the medical and scientific community to provide evidence that demonstrates long-term changes in neural circuitry in humans as a result of viewing VSS, a valid and empirically-based model of addiction that is specific to VSS-use, or an addiction-based therapy model that is efficacious in reducing self-reported problematic porn use and sexual behavior (Ley et al., 2014).

They are not the only researchers to come to these conclusions. In fact, so many researchers and clinicians have arrived at similar conclusions that the American Association of Sexual Educators, Counselors, and Therapists was prompted to issue an official statement (2016) on the matter which included the following language:

> AASECT 1) does not find sufficient empirical evidence to support the classification of sex addiction or porn addiction as a mental health disorder, and 2) does not find the sexual addiction training and treatment methods and educational pedagogies to be adequately informed by accurate human sexuality knowledge. Therefore, it is the position

> of AASECT that linking problems related to sexual urges, thoughts or behaviors to a porn/sexual addiction process cannot be advanced by AASECT as a standard of practice for sexuality education delivery, counseling or therapy.

Based on this review, it seems that what evidence there is to suggest an addiction model for VSS-use and compulsive sexual behavior is, at this stage, incomplete and falsifiable. If clinicians are going to continue to operate under the assumption that porn and sex have addictive properties, then it appears the scientific community still has quite a lot of work to do to establish a proper basis for that assumption. Until that time, it is probably best that clinicians, researchers, healthcare providers and mainstream outlets adopt the APA's suggested language that these are, in their problematic states, compulsive behaviors, but not addictions.

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