

ORIGINAL RESEARCH

Is Pornography Use Related to Erectile Functioning? Results From Cross-Sectional and Latent Growth Curve Analyses

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ABSTRACT

Introduction: Despite evidence to the contrary, a number of advocacy and self-help groups persist in claiming that internet pornography use is driving an epidemic of erectile dysfunction (ED).

Aim: The present work sought to explore whether mere pornography use itself and self-reported problematic use of pornography are related to ED, both cross-sectionally and longitudinally.

Methods: A series of 3 samples of sexually active men who also used pornography were collected: a cross-sectional sample of undergraduate men in the United States ($n = 147$), an online sample of men derived from a larger sample that was matched to U.S. nationally representative norms ($n = 297$), and a 1-year, 4-wave longitudinal sample of adult men derived from an online convenience sample (Mechanical Turk: time 1, $n = 433$; time 2, $n = 223$; time 3, $n = 202$; time 4, $n = 196$). Pearson correlations and cross-sectional structural equation models were conducted in each sample. Latent growth curve analyses were conducted in the longitudinal sample.

Main Outcome Measure: The primary outcomes of interest were cross-sectional and longitudinal reports of erectile functioning as measured by the International Index of Erectile Functioning 5.

Results: Across all 3 samples, there was evidence of a positive, cross-sectional association between self-reported problematic use and ED, but no consistent association between mere use itself and ED. In our longitudinal sample, there were correlations among baseline pornography use, baseline self-reported problematic use, and prospective ED at times 2–4; however, latent growth curve analyses demonstrated no significant relationships between any pornography-related variables and trajectories of ED.

Clinical Implications: These results suggest that among non-treatment-seeking pornography users, self-reported problematic use likely is associated with concurrent reports of ED, but that the links between these variables are not directional or causal in nature.

Strength & Limitations: This work is the first work to systematically examine the links between self-reported problematic use of pornography and ED, and it did so in a variety of samples, using both cross-sectional and longitudinal methods. Even so, the work relied exclusively on self-report methods, and did not control for medical covariates that may be related to the experience of ED.

Conclusion: In conjunction with prior literature, we conclude that there is little or no evidence of an association between mere pornography use and ED, consistent evidence of an association between self-reported problematic use and ED cross-sectionally, and no evidence of causal links between any pornography variables and ED.

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Key Words: Erectile Dysfunction; Pornography; Compulsive Sexual Behavior Disorder; Hypersexual Behavior; Addiction; Moral Incongruence

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INTRODUCTION

Internet pornography use is ubiquitous in modern nations that do not censor online content. In the United States, roughly 46% of adult men and 16% of adult women acknowledge consuming online pornography within the previous week.¹ Similarly, in Poland, 47% of men and 27% of women consumed it in the

previous month,² and in Australia, 76% of adult men and 41% of adult women acknowledge intentionally viewing pornography within the previous year.³ Despite the popularity of pornography, its use remains a highly contentious topic.

Various authors have decried the deleterious effects of pornography,^{4,5} whereas others have argued that pornography use is not necessarily inherently problematic.^{6–8} Even so, claims of pornography's harms have proliferated, with everything from relationship failures,⁹ to psychiatric illnesses,¹⁰ to sexual dysfunction¹¹ being blamed on this form of media. The last of these purported claims is the focus of the present work. Specifically, a number of popular antipornography groups have posited that Internet pornography use is a causal factor in experiences of sexual dysfunction in men—particularly erectile dysfunction (ED).^{12–14} Despite the popularity of these groups and their associated movements, there is a relative paucity of academic literature attempting to test the claim that pornography use is somehow associated with greater experiences of ED. In the present work, we sought to examine these claims empirically, specifically exploring whether pornography use is indeed associated with reported ED.

Problematic Pornography Use

Central to the premise that pornography may be driving ED is the idea that pornography use may be problematic at times or in some forms. In some senses, this is a well-established fact. Some pornography users report that they find their own use problematic,^{15–18} some users report life-altering consequences as a result of their use,¹⁹ some users report feeling addicted to pornography,^{20,21} and some users express profound regret over their pornography use.^{22,23} Not surprisingly then, there is quite a bit of evidence that many people do seek professional mental health services as a means of obtaining help for their self-reported problems with pornography use.^{24–26} Moreover, many mental health providers report encountering problematic pornography use in their clinical practice,^{27–30} and there are some reports of various treatment modalities for addressing problematic pornography use.^{31–34} Despite these facts, the notion of problematic pornography use remains controversial.

Although the topic of problematic pornography use is prevalent in both academic³⁵ and popular^{5,10,36} literature and despite the increasing amount of research on this topic,^{37–42} at present, the mental health community remains divided as to whether or not problematic pornography use represents a discrete or meaningful form of psychopathology or distress. For example, several groups have argued that the ideas of pornography addiction and problematic pornography use are not supported by empirical literature.^{6,8,43,44} Similarly, in studies of nonclinical samples—that is, convenience or community samples (as opposed to persons seeking treatment for concerns about pornography use)—religiousness and moral incongruence regarding pornography use are consistently the best predictors of self-perceived problems around use.^{45–47} These findings have

been replicated in nationally representative samples of U.S. adults as well.⁴⁸ Such findings suggest that pornography use itself, although clearly related to self-perceived problems around use,²⁴ often might not be the driving factor in whether or not one experiences feelings of addiction, compulsivity, or disruption.^{47,49}

In summary, it seems reasonable to conclude that pornography use is common and controversial, with some users reporting problems associated with their use. The scope and etiology of these problems remain unclear, with a range of factors, including moral incongruence, religiousness, and time spent viewing pornography, all emerging as potential predictors of such problems. Even so, the effects of self-perceived problematic use are of clinical concern, because such self-perceptions have been cross-sectionally linked to other addictive behavior patterns,⁵⁰ relationship difficulties,⁵¹ psychological distress,¹⁵ diminished sexual well-being,^{52,53} and diminished religious and spiritual well-being.⁵⁴ Moreover, over time, self-perceived problematic pornography use has been linked to psychological distress⁵⁵ and diminished religious and spiritual well-being.⁵⁶ Despite such links, however, whether self-perceived problematic pornography use is linked to ED remains unclear.

Pornography Use and ED

Given the relative lack of literature exploring the topic, in the present work we sought to examine whether self-reported Internet pornography use is associated with greater experience of ED.^{5,12–14} Historically, the experience of erectile concerns or mild ED was thought to be an inevitable concern of aging and an indicator of cardiovascular health and generally nonexistent in young, otherwise healthy, men. However, in recent years, research countering this narrative has emerged. Specifically, intermittent concerns with erectile functioning or occasional experiences of ED in partnered sexual experiences are not uncommon, both in the United States⁵⁷ and internationally.⁵⁸ In general, younger men do not experience such problems as frequently or as persistently as older men, but such experiences among younger men are not altogether rare.^{57–59} It does not seem that there has been an increase in such problems (or at least in reporting them) in recent generations, although the academic literature has expressed more awareness of these mild erectile issues in recent years.

To date, only limited studies have been published examining how pornography use might be related to actual ED. In 1 laboratory-based study, men's reports of consumption of sexual media was related to greater sexual responsiveness to sexual media and seemingly unrelated to partnered erectile functioning.⁶⁰ Although these findings were considered controversial,⁶¹ the data were inconsistent with the idea that mere pornography use is directly related to diminished erectile functioning. Similarly, an international study of heterosexual men in Norway, Portugal, and Croatia found no consistent relationships between ED and mere pornography use in either direction.⁶²

In summary, the current research is almost entirely inconsistent with claims that pornography is fueling increases in partnered ED among men. However, this previous work is limited to very few studies and largely focuses only on mere pornography use itself (eg, how many hours per day used or how frequently used), rather than on self-reported problems with pornography use or self-reported feelings of addiction or dysregulation. Although previously unexplored, the notion that self-reported feelings of problematic pornography use might be associated with ED is not altogether without precedent. Specifically, some previous research has found that hypersexuality more generally—feeling compulsive and dysregulated in one's general sexual behavior—is associated with greater reports of ED.⁶³ As such, it is at least plausible that feelings of compulsivity or dysregulation in pornography use also may be associated with diminished erectile functioning. This possibility was the focus of the present work.

The Present Study

Building on the previously reviewed research, we sought to examine how pornography use—particularly self-reported feelings of problematic pornography use—may be associated with self-reported ED in men in the United States, both cross-sectionally and over time. We specifically aimed to test the question of whether pornography use itself is related to ED in either direction for men, both cross-sectionally and over time. We further aimed to explore whether self-reported feelings of problematic use is associated with reports of diminished ED, both cross-sectionally and over time. Finally, given that previous work has linked self-reported problematic pornography use to feelings of moral incongruence around pornography use, we also sought to examine the foregoing constructs above and beyond the role of moral incongruence.

MATERIALS AND METHODS

To address the aforementioned issues, we collected 3 independent samples of sexually active Internet pornography using men. Here we review the details of each sample, including participant information and measurement strategies. Research in each of the samples was approved by Bowling Green University's Institutional Review Board. Each participant provided informed consent for the present study before completing subsequent measures.

Participants

Sample 1

Participants in our first sample were sexually active undergraduate men in psychology courses at a large midwestern public university in fall 2017 and spring 2018, who also acknowledged viewing pornography ($n = 147$; mean age 19.8 ± 3.7 years; 79.5% white, 14.4% black/African American, 4.8% Latinx/Hispanic, 3.4% Middle Eastern, 2.1% Asian/Pacific Islander, 1.4% American Indian/Native American/Alaska Native, 1.4% other/prefer not to say).

Sample 2

Our second sample was derived from a larger sample of both men and women ($n = 1,000$), which was matched to nationally norms based on U.S. Census region, age, race, ethnicity, sex, and income with TurkPrime (Prime Research, New York, NY). We restricted our analyses to sexually active Internet-using men, who also acknowledged viewing pornography ($n = 297$; mean age, 46.5 ± 15.3 years; 68.4% white, 14.1% black/African American, 6.4% Latinx/Hispanic, 10.1% Asian/Pacific Islander, 2.7% American Indian/Native American/Alaska Native, 2.4% other/prefer not to say). Because this was an opt-in online survey, the sample was not a probability sample and does not necessarily represent a truly representative cross-section of the U.S. population, although it is more heterogenous in composition than our other samples.

Sample 3

Participants (an online convenience sample recruited from Amazon's Mechanical Turk using the TurkPrime service extension⁶⁴) for our final sample were sexually active, Internet-using men in the United States, who acknowledged viewing pornography ($n = 433$; mean age, 33.5 ± 9.7 years; 79.0% white, 8.3% black/African American, 8.8% Latinx/Hispanic, 0.2 % Middle Eastern, 7.2% Asian/Pacific Islander, 2.5% American Indian/Native American/Alaska Native, 0.0% other/prefer not to say). Participants were initially recruited in spring 2017 and recontacted periodically thereafter. Participants were compensated \$5.00 at baseline and \$5.00 at each subsequent follow-up point.

In sample 3, participants who completed baseline measures were offered the opportunity to participate in follow-up surveys at 4-month intervals for a period of 12 months after baseline (4 surveys: baseline, 4 months, 8 months, and 12 months). Participants were contacted at each interval after baseline, regardless of whether they had completed subsequent follow-ups (ie, all participants from baseline were contacted again at 8 months, irrespective of participation at 4 months). Of the 433 participants at baseline, 223 completed the follow-up at 4 months (retention rate, 51.5%), 202 completed the follow-up measure of erectile functioning at 8 months (retention rate, 46.7%), and 196 completed the follow-up at 12 months (retention rate, 45.3%). Across all 4 time points, only 117 participants had complete data. However, 278 participants had at least 2 time points of data (eg, baseline plus 1 subsequent point). For these participants (those with 2 points of data), patterns of missingness were tested for missingness completely at random (MCAR) using the BaylorEdPsych⁶⁵ package for R statistical software (www.R-project.org). Using Little's test for MCAR,⁶⁶ no discernible pattern of missing data was found [$\chi^2(15) = 12.6$; $P = .631$]. As such, for subsequent latent growth curve (LGC) models, missing data points were estimated using full information maximum likelihood (FIML) techniques.^{67,68}

Measures

Similar measures were used across studies with some variations, as delineated below. Descriptive statistics, including

measures of internal reliability (Cronbach's α) are available in Tables 1, 2, and 3 for samples 1, 2, and 3 respectively. Unless noted otherwise, scores were obtained by averaging across items (ie, mean scores were calculated).

Erectile Functioning

In all 3 samples, we assessed erectile functioning via the International Index of Erectile Functioning-5 (IIEF-5).⁶⁹ This scale requires participants to rate the quality of their erections during partnered sexual interactions over the previous 6 months by responding to 5 items (eg, "How do you rate your confidence that you could get and keep an erection?") on a scale of 1–5. Anchors for each item vary (eg, 1 = very low or never/almost never to 5 = very high or always/almost always). This measure was repeated at times 2–4 for sample 3, and responses were summed.

Pornography Use

In samples 1 and 3, we assessed pornography use via responses to a single item: "On average, I estimate that I spend ____ hours viewing pornography online per day." This measure was repeated at times 2–4 for sample 3. In sample 2, we assessed pornography use via responses to 2 questions. Similar to samples 1 and 3, we asked participants to report average daily use (eg, "On average, I estimate that I spend ____ minutes viewing pornography online per day"). We also asked participants to rate their frequency of pornography use over the past year. Participants responded to a single question—"In the past 12 months, how often have you viewed pornography alone (ie, without a partner)?"—on a scale of 1 (never) to 8 (once daily or more).

Self-Reported Problematic Pornography Use

In all 3 samples, problematic pornography use was assessed using a 4-item, abridged version of the Cyber Pornography Use Inventory 9 (CPUI-9).⁷⁰ In its original form, the CPUI-9 assessed problematic pornography use via three 3-item subscales: Perceived Compulsivity (eg, "I believe I am addicted to Internet pornography"), Access Efforts ("I have put off things I needed to do in order to view pornography"), and Emotional Distress ("I feel depressed after viewing pornography online"). Although well-validated and widely used in a variety of samples and cultural contexts, the full, 9-item version of the scale has been criticized for confounding emotional distress about use with self-reported problems with use.^{71,72} Consequently, for the present work, we adapted the CPUI-9 to a brief, 4-item measure that focuses simply on perceived loss of control related to pornography use. These 4 items consist of the original 3 items of the Perceived Compulsivity subscale (ie, "I believe I am addicted to Internet pornography," "I feel unable to stop my use of online pornography," and "Even when I do not want to view pornography online, I feel drawn to it") along with 1 item from the original Access Efforts subscale ("I have put off things I needed to do in order to view pornography"). Responses were recorded on a scale of 1 (strongly disagree) to 7 (strongly agree).

Across all 3 samples, latent variable analyses (eg, confirmatory factor analysis using diagonally weighted least squares estimation with robust standard errors and mean adjusted test statistics) demonstrated that this abridged CPUI-4 demonstrated excellent fit:

- Sample 1: $\chi^2(2) = 0.198$, $P = .635$, robust comparative fit index (CFI) = 1.00, robust Tucker–Lewis index (TLI) = 1.02, robust root mean square error of approximation (RMSEA) = 0.000, standardized root mean square residual (SRMR) = 0.010
- Sample 2: $\chi^2(2) = 9.49$, $P = .009$, robust CFI = 0.992, robust TLI = 0.977, robust RMSEA = 0.036, SRMR = 0.017
- Sample 3: $\chi^2(2) = 0.98$, $P = .613$, robust CFI = 1.00, robust TLI = 1.00, robust RMSEA = 0.000, SRMR = 0.005. These measures were repeated at times 2–4 for sample 3.

Moral Incongruence

In all 3 samples, moral incongruence among pornography users was measured using 4 items that have been used in previous studies.^{22,71,73} Participants rated their agreement with statements (eg, "Viewing pornography troubles my conscience") on a scale of 1 (strongly disagree) to 7 (strongly agree).

Religiousness

In samples 1 and 3, religiousness was measured as the aggregate of both religious belief salience and religious participation. We included a 5-item inventory adapted from a popular measure of religious belief salience, the Blaine and Crocker Religious Belief Salience scale,⁷⁴ omitting 1 item that was focused on the concept of a monotheistic deity. For the present study, this scale required participants to rate agreement with a series of statements (eg, "Being a religious/spiritual person is important to me") on a scale of 0 (strongly disagree) to 10 (strongly agree). We also included an adaptation of a measure of religious participation⁷⁵ that assessed weekly activities, such as prayer and religious service attendance on a scale of 0 (not at all) to 5 (more than once per day). Individual items on both measures were standardized, and then a total religiousness score was calculated by averaging across all 9 standardized items. This strategy for assessing religiousness has been used extensively in the past,⁷⁶ including in studies of pornography use.⁷³

In sample 2, religiousness was assessed via agreement with 3 items—"I consider myself religious," "Being religious is important to me," and "I attend religious services regularly"—rated on a scale of 1 (strongly disagree) to 7 (strongly agree).

Analytic Plan

Post hoc sensitivity analyses revealed that our samples were adequately powered (power = 0.080; $\alpha = 0.05$) to detect small to moderate correlations (sample 1 [$n = 147$], $r = 0.229$; sample 2 [$n = 297$], $r = 0.16$; sample 3 [$n = 433$], $r = 0.13$). Moreover, regression-based analyses for each sample were adequately

Table 1. Descriptive statistics and Pearson correlations for key variables in sample 1

Variable	Mean (SD)	Skew	1	2	3	4	5
Average daily pornography use, h^*	0.38 (0.40)	1.87*	$\alpha = \text{N/A}$				
Problematic pornography use (CPUI-4)	2.71 (2.25)	0.51	0.32 [†]	$\alpha = 0.87$			
Erectile functioning (IIEF-5)	22.07 (3.10)	-1.26	-0.18	-0.20	$\alpha = .76$		
Religiousness	0.09 (0.86)	0.26	0.21	0.21	-0.10	$\alpha = 0.94$	
Moral incongruence	3.08 (1.77)	0.41	0.07	0.51 [†]	-0.06	0.50 [†]	$\alpha = 0.92$

CPUI-4 = Cyber Pornography Use Inventory-4; IIEF-5 = International Index of Erectile Functioning-5; N/A = not applicable.

*Due to the highly skewed nature of this variable in subsequent samples, cube root transformations were conducted to reduce skew (transformed variable skew = -0.35) before analyses. Results of subsequent analyses (correlations/SEM) indicated no apparent differences in sign, relative size, or significance for any analyses using either the raw variable or the transformed variable. As such, descriptive statistics represent the raw variable, and all further analyses reflect the transformed variable.

[†] $P < .001$ with Holm-adjusted test statistics for multiple comparisons.

powered to predict relatively small effect sizes as well (sample 1, 4 IVs, $f^2 = 0.083$; sample 2, 6 IVs, $f^2 = 0.047$; sample 3, 5 IVs, $f^2 = 0.030$).

Regarding our latent variable analyses, there is a great deal of controversy⁷⁷ over the appropriateness of using such methods in small sample sizes (eg, $n < 200$), such as our sample 1. Even so, previous evaluations of the topic have concluded that well-specified and theoretically sound models may be testable in even very small samples (eg, $n < 100$).^{78–80} Moreover, simulation studies have found that certain criteria of fit (eg, RMSEA $< .06$) may be unduly strict in models with a small sample size.⁸¹ Given such factors, a model such as our sample 1 that is consistent with later, higher-powered models (our samples 2 and 3) and demonstrating excellent fit is likely a fair representation of the underlying latent structure.

We performed a similar set of analyses for all samples. First, descriptive statistics and Pearson correlations were conducted between all observed variables. For Pearson correlations, Holm-

adjusted test statistics were used to correct for multiple comparisons and minimize the likelihood of type I errors.⁸² The Holm correction is a sequentially rejective version of the simple Bonferroni correction for multiple comparisons and strongly controls the familywise error rate at a set α value ($\alpha = 0.05$ for this set of analyses).⁸² These results are available in Tables 1–3.

In samples 1 and 2, as well as for baseline analyses in sample 3, initial analyses were followed by a structural equation model (SEM) in the lavaan⁶⁸ package for R statistical software. For all 3 of these analyses, robust diagonally weighted least squares estimation with mean adjusted test statistics was used.^{83,84} In all 3 samples, the latent variable “self-reported problematic pornography” use was defined by the observed variables that are the items of the previously described CPUI-4. Similarly, the latent variable “erectile functioning” was defined by the observed variables that are the items of the IIEF-5. Across all 3 samples, control variables were regressed on both latent variables

Table 2. Descriptive statistics and Pearson correlations for key variables in sample 2

Variable	Mean (SD)	Skew	1	2	3	4	5	6	7
Average daily pornography use, min^*	13.06 (20.88)	3.30*	$\alpha = \text{N/A}$						
Frequency of pornography use	4.40 (2.54)	-0.05	0.47 [†]	$\alpha = \text{N/A}$					
Problematic pornography use (CPUI-4)	2.14 (1.53)	1.20	0.19 [‡]	0.21 [†]	$\alpha = 0.91$				
Erectile functioning (IIEF-5)	20.07 (5.58)	-1.30	-0.05	0.00	-0.21 [†]	$\alpha = 0.93$			
Religiousness	3.83 (2.03)	0.02	-0.08 [§]	-0.19 [‡]	0.13	-0.08	$\alpha = 0.93$		
Moral incongruence	2.88 (1.89)	0.64	-0.03	-0.09	0.57 [†]	-0.14	0.49 [†]	$\alpha = 0.94$	
Age	46.52 (15.31)	0.01	-0.15	-0.22 [†]	-0.29 [†]	-0.24 [†]	0.06	-0.15	$\alpha = \text{N/A}$

CPUI-4 = Cyber Pornography Use Inventory-4; IIEF-5 = International Index of Erectile Functioning-5; N/A = not applicable.

*Due to the highly skewed nature of this variable, cube root transformations were conducted to reduce skew (transformed variable skew = 0.61) before analyses. Results of subsequent analyses (correlations/SEM) indicated no apparent differences in sign, relative size, or significance for any analyses using either the raw variable or the transformed variable. As such, descriptive statistics represent the raw variable, and all further analyses reflect the transformed variable.

[†] $P < .001$, with Holm-adjusted test statistics for multiple comparisons.

[‡] $P < .01$, with Holm-adjusted test statistics for multiple comparisons.

[§] $P < .05$, with Holm-adjusted test statistics for multiple comparisons.

Table 3. Descriptive statistics and Pearson correlations for key variables in sample 3

Variable	Mean (SD)	Skew	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Average daily use*	0.75 (1.36)	3.91	–													
4 mo	0.71 (1.32)	4.26	0.62 [†]	–												
8 mo	0.64 (1.26)	5.19	0.49 [†]	0.63 [†]	–											
12 mo	0.60 (1.18)	6.00	0.48 [†]	0.54 [†]	0.50 [†]	–										
SRPPU																
Baseline	2.57 (1.47)	0.71	0.43 [†]	0.38 [†]	0.28 [†]	0.32 [†]	$\alpha = 0.88$									
4 mo	2.48 (1.47)	0.89	0.32 [†]	0.43 [†]	0.38 [†]	0.41 [†]	0.72 [†]	$\alpha = 0.90$								
8 mo	2.41 (1.43)	0.90	0.32 [†]	0.35 [†]	0.34 [†]	0.37 [†]	0.72 [†]	0.82 [†]	$\alpha = 0.90$							
12 mo	2.38 (1.45)	0.83	0.28 [†]	0.37 [†]	0.34 [†]	0.37 [†]	0.71 [†]	0.75 [†]	0.84 [†]	$\alpha = 0.88$						
Erectile functioning	22.15 (3.69)	–1.60	–0.37 [†]	–0.33 [†]	–0.27 [†]	–0.32 [†]	–0.33 [†]	–0.30 [†]	–0.22 [†]	–0.24 [†]	$\alpha = 0.85$					
Baseline																
4 mo	21.93 (3.45)	–1.19	–0.40 [†]	–0.43 [†]	–0.45 [†]	–0.35 [†]	–0.31 [†]	–0.39 [†]	–0.37 [†]	–0.36 [†]	0.65 [†]	$\alpha = 0.82$				
8 mo	4.51 (0.66)	–1.43	–0.27 [†]	–0.36 [†]	–0.32 [†]	–0.30 [†]	–0.35 [†]	–0.33 [†]	–0.40 [†]	–0.42 [†]	0.73 [†]	0.67 [†]	$\alpha = 0.88$			
12 mo	4.51 (0.7)	1.68	–0.34 [†]	–0.34 [†]	–0.27 [†]	–0.32 [†]	–0.34 [†]	–0.26 [†]	–0.23	–0.33 [†]	0.73 [†]	0.76 [†]	0.77 [†]	$\alpha = 0.85$		
Religiousness	–0.04 (0.69)	0.66	0.26 [†]	0.26 [†]	0.25 [†]	0.14	0.22 [†]	0.31 [†]	0.23 [†]	0.15	–0.15	–0.21 [†]	–0.10	–0.10	$\alpha = 0.92$	
Moral incongruence	2.25 (1.57)	1.15	0.24 [†]	0.23 [†]	0.22 [†]	0.19 [†]	0.53 [†]	0.47 [†]	0.48 [†]	0.48 [†]	–0.33 [†]	–0.30 [†]	–0.37 [†]	–0.36 [†]	0.42 [†]	$\alpha = 0.94$
Age at baseline	33.55 (9.98)	1.38	–0.19	–0.18	–0.21 [†]	–0.08	–0.15	–0.13	–0.10	–0.08	0.12	0.23 [†]	0.16	0.20	–0.10	–0.15

SRPPU = self-reported problematic pornography use.

*Due to the highly skewed nature of these variables, cube root transformations were conducted to reduce skew (transformed variable skew; baseline = 0.76, time 2 = 0.72, time 3 = 0.90, time 4 = 0.58) before analyses.

[†] $P < .00$, with Holm-adjusted test statistics for multiple comparisons.

[‡] $P < .05$, with Holm-adjusted test statistics for multiple comparisons.

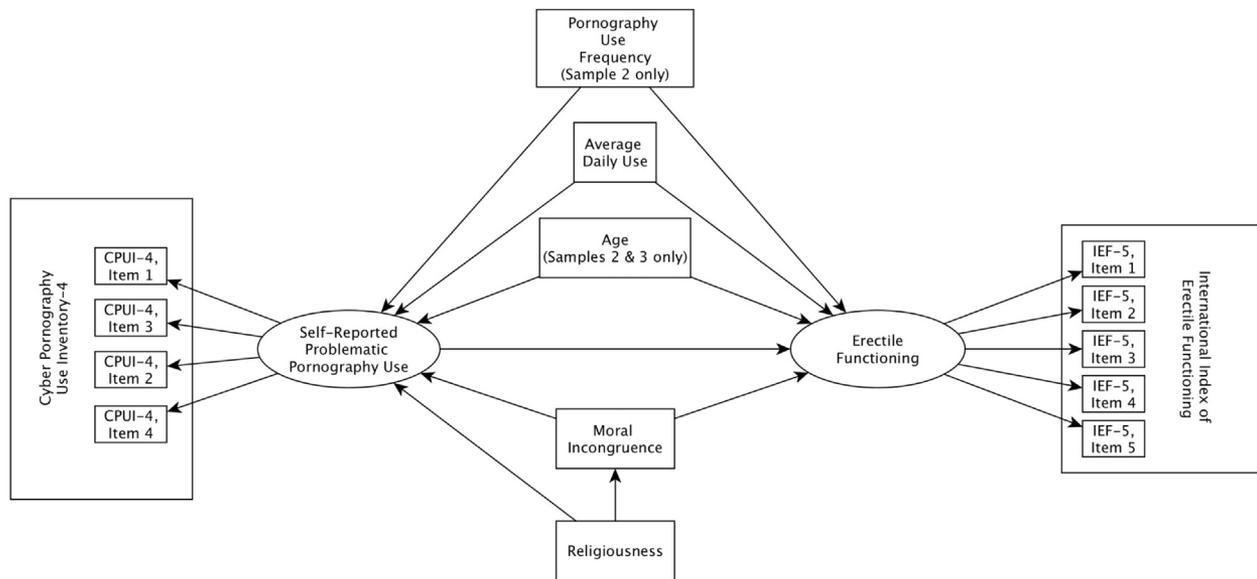


Figure 1. Samples 1–3, path diagram of cross-sectional structural equation models predicting erectile functioning. All controls (exogenous variables) were allowed to covary, but these results are omitted from results for clarity.

(Figure 1). All exogenous predictor variables were correlated with one another, although these results are omitted from Figure 1 for the sake of clarity.

In our longitudinal follow-up for sample 3 (Figure 2), we computed LGC models using the lavaan package for R.⁶⁸ In this model, the intercept and slope of erectile functioning were defined by the 4 observed values of the IIEF-5 at each time point. As noted earlier, only 117 participants had complete data across all 4 time points. However, 278 participants had baseline data and data for 1 follow-up time point. Multivariate analysis of variance revealed no multivariate differences (Wilk’s $\lambda = 0.990$; $F[5, 407] = 0.848$; $P = .516$) between participants who completed more than 1 wave and those who did not, based on key variables: pornography use, erectile functioning, moral incongruence, religiousness, and self-reported pornography problems. Given that analyses for MCAR found no patterns to missingness among participants with 2 data points, all 278 participants were included, with missing data points estimated using FIML techniques. Within this LGC model, the latent variables “erectile functioning slope” and “erectile functioning intercept” were regressed on by the observed baseline variables of age, pornography use, self-reported problematic use (CPUi-4), religiousness, and moral incongruence. All exogenous predictor variables were correlated with one another, although these results are omitted from Figure 2 for the sake of clarity. In addition, in an exploratory capacity, we also conditioned 2 parallel process growth curve models for erectile functioning and both pornography use and self-reported problematic use.

RESULTS

Correlational Analyses

Results from all correlational analyses are provided in Tables 1–3. Across the 3 samples, positive relationships were

consistently observed among moral incongruence, problematic pornography use, and religiousness. For the relationship between moral incongruence and religiousness and the relationship between moral incongruence and problematic pornography use, the magnitude of association was most often quite high ($r = 0.45–0.57$). Similarly, there were consistent negative relationships between erectile functioning and problematic pornography use in all 3 samples, although this relationship was of only small to moderate magnitude ($r = -0.20$ to -0.33) and did not maintain statistical significance in sample 1 after application of the Holm correction. Notably, in sample 3, self-reported problematic pornography use at baseline was negatively associated with erectile functioning over time at each time point, as was moral incongruence.

The associations between pornography use and self-reported problematic pornography use were consistently present and positive ($r = 0.19–0.44$). However, with the exception of sample 3, there was little evidence of a link between pornography use itself and erectile functioning. In samples 1 and 2, the links between pornography use and erectile functioning were consistently weak and insignificant; however, in sample 2, there were consistent negative associations between average daily use and erectile functioning both at baseline and over time.

Cross-Sectional Structural Equation Models

Results from the previously described SEMs were also relatively consistent, with some variations, across samples. All 3 baseline SEMs (Tables 4 and 5) showed acceptable to excellent fits:

- Sample 1: $\chi^2(49) = 61.64$, $P = .106$, robust CFI = 0.990, robust TLI = 0.986, robust RMSEA = 0.033, SRMR = 0.057

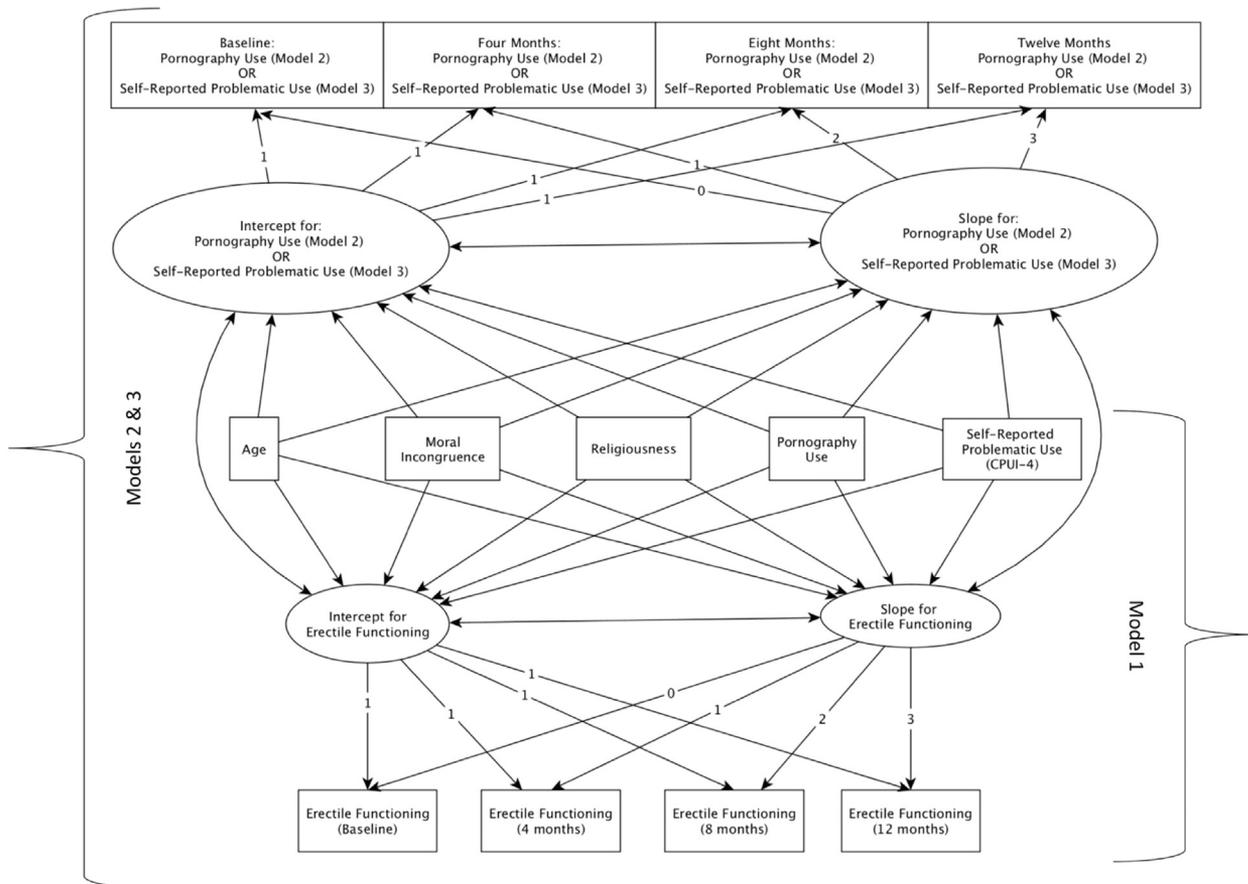


Figure 2. LGC models for sample 3. Model 1 represents a single process, linear model. Models 2 and 3 represent parallel process growth models with linear slopes estimated for internet pornography use and self-reported problematic use, respectively. All controls (exogenous variables) were allowed to covary, but these data are omitted from the results for clarity.

- Sample 2: robust $\chi^2(65) = 121.41, P < .001$, robust CFI = 0.991, robust TLI = 0.988, robust RMSEA = 0.030, SRMR = 0.035
- Sample 3, time 1: robust $\chi^2(57) = 135.89, P < .001$, robust CFI = 0.988, robust TLI = 0.984, robust RMSEA = 0.035, SRMR = 0.038.

In all 3 baseline SEMs, self-reported problematic pornography use was best predicted by moral incongruence about pornography use while still being significantly predicted by pornography use itself in each sample. Cross-sectionally, there was a consistent negative relationship between self-reported problematic pornography use and erectile functioning, although this relationship was statistically significant only in samples 2 and 3 (Tables 4 and 5). In addition, in sample 2, in which age was much more evenly distributed to match U.S. norms, there was a significant negative relationship between age and erectile functioning. Finally, only in sample 3 was there a significant cross-sectional relationship (negative) between pornography use and erectile functioning.

LGC Models

In our LGC model from sample 3 (Figure 2 and Table 6 present slope and intercept estimates), excellent fit was

obtained for a single-process linear model: $\chi^2(15) = 21.17, P = 0.131, CFI = 0.989, TLI = 0.981, RMSEA = 0.040, SRMR = 0.026$.* The slope of this latent variable thus obtained was statistically indistinguishable from 0 (slope = 0.22, $P = .463$) with an insignificant variance term as well (variance = 0.01, $P = .964$), indicating relative stability of erectile functioning in pornography users over a 1-year period. In this model (Table 6), consistent with baseline data, moral incongruence, pornography use, and self-reported problematic use all predicted the intercept of erectile functioning. However, no baseline variables emerged as predictors of the slope of

* In an exploratory capacity, we also plotted this growth curve as a quadratic function [$\chi^2(15) = 20.016, P = .168, CFI = 0.991, TLI = 0.985, RMSEA = 0.036, SRMR = 0.024$] and as a cubic function [$\chi^2(15) = 20.11, P = .131, CFI = 0.991, TLI = 0.984, RMSEA = 0.036, SRMR = 0.024$], rather than a linear function. Results revealed no significant increase in fit or explanatory power. As such, we elected to retain the more parsimonious linear model. We also tested more restricted models with constrained residual variances for each data point [$\chi^2(18) = 28.60, P = .053; CFI = 0.981, TLI = 0.973, RMSEA = 0.048, SRMR = 0.027$], as well as a model in which residual variances were constrained, as well as the mean latent slope [$\chi^2(20) = 30.989, P = .055, CFI = 0.980, TLI = 0.975, RMSEA = 0.046, SRMR = 0.029$]. Again, in both cases, there was no statistically detectable improvement in fit. As such, the unconstrained linear model was retained for subsequent analyses.

Table 4. Samples 1–3, standardized item loadings for latent variables in structural equation models

Variable	Sample 1	Sample 2	Sample 3
Self-reported problematic pornography use (Cyber Pornography Use Inventory 4)			
I believe I am addicted to Internet pornography	0.863	0.890	0.868
I feel unable to stop my use of online pornography	0.886	0.876	0.883
Even when I do not want to view pornography online, I feel drawn to it	0.888	0.864	0.810
I have put off things I needed to do in order to view pornography	0.582	0.731	0.687
Erectile functioning (International Index of Erectile Functioning)			
How do you rate your confidence that you could get and keep an erection?	0.663	0.759	0.663
When you had erections with sexual stimulation, how often were your erections hard enough for penetration?	0.815	0.935	0.854
During sexual intercourse, how often were you able to maintain your erection after you had penetrated (entered) your partner?	0.669	0.926	0.856
During sexual intercourse, how difficult was it to maintain your erection to completion of intercourse?	0.599	0.886	0.601
When you attempted sexual intercourse, how often was it satisfactory for you?	0.477	0.794	0.757

Sample 1: $\chi^2(49) = 61.64, P = .106$, robust comparative fit index (CFI) = 0.990, robust Tucker–Lewis index (TLI) = 0.986, robust root mean square error of approximation (RMSEA) = 0.033; standardized root mean square residual (SRMR) = 0.057.

Sample 2: robust $\chi^2(65) = 121.41, P < .001$, robust CFI = 0.991, robust TLI = 0.988, robust RMSEA = 0.030; SRMR = 0.035.

Sample 3, time 1: robust $\chi^2(57) = 135.89, P < .001$, robust CFI = 0.988, robust TLI = 0.984, robust RMSEA = 0.035; SRMR = 0.038.

erectile functioning over time, owing to the general absence of change over time, as indicated by slope intercept and variance values that were indistinguishable from 0. Given that the mean and variance of the slope in this growth curve were insignificant (ie, there was no change over time), an intercept-only model was computed for the sake of parsimony. **In short, although there were links between included covariates and baseline levels of erectile functioning, there was no evidence to suggest that any of the included covariates predicted any change in erectile functioning over time, because no such change occurred.**

Building on this single-process linear model, we conditioned 2 additional parallel-process models (Figure 2 and Table 6). In the former, we estimated growth curves for both erectile functioning

and average daily use of pornography, obtaining excellent fit for the model: $\chi^2(38) = 47.26, P = .144$; CFI = 0.990, TLI = 0.984, RMSEA = 0.031, SRMR = 0.033. The slope of average daily use of pornography was statistically indistinguishable from 0 (slope = -0.01, $P = .257$; variance = 0.00, $P = .097$), indicating stability in trajectories of pornography use over a 1-year period. In this model, consistent with the linear model, although self-reported problematic use emerged as a significant predictor of latent intercepts for both erectile functioning and average daily use, given that the mean and variance of the slopes in all both curves was insignificant (ie, there was no change over time), an intercept-only model was computed for the sake of parsimony.

Table 5. Samples 1–3, standardized path coefficients predicting self-reported problematic use and erectile functioning

Variable	Self-reported problematic use			Erectile functioning		
	Sample 1	Sample 2	Sample 3	Sample 1	Sample 2	Sample 3
Age	—	0.258*	-0.079	—	-0.359*	0.015
Average pornography use	0.316*	0.118	0.379*	-0.176	-0.041	-0.202†
Frequency of pornography use	—	0.164†	—	—	0.041	—
Self-reported problematic use	—	—	—	-0.141	-0.378*	-0.166†
Moral incongruence	0.551*	0.670*	0.571*	0.029	0.064	-0.180†
Religiousness	-0.111	-0.103	-0.157*	—	—	—

Sample 1: $\chi^2(49) = 61.64, P = .106$, robust comparative fit index (CFI) = 0.990, robust Tucker–Lewis index (TLI) = 0.986, robust root mean square error of approximation (RMSEA) = 0.033; standardized root mean square residual (SRMR) = 0.057.

Sample 2: robust $\chi^2(65) = 121.41, P < .001$, robust CFI = 0.991, robust TLI = 0.988, robust RMSEA = 0.030, SRMR = 0.035.

Sample 3, time 1: robust $\chi^2(57) = 135.89, P < .001$, robust CFI = 0.988, robust TLI = 0.984, robust RMSEA = 0.035, SRMR = 0.038.

All controls (exogenous variables) were allowed to covary, but these results are omitted from results for clarity.

* $P < .001$.

† $P < .05$.

Table 6. Sample 3, LGC model, nonstandardized path coefficients of exogenous variables predicting slopes and intercepts of linear model and parallel growth process models

Variable	Model 1, EF linear slope, LGC		Model 2, parallel pornography use with EF linear slope				Model 3, parallel self-reported problems with EF linear slope			
	Slope	Intercept	EF slope	EF intercept	PU slope	PU intercept	EF slope	EF intercept	SRPPU slope	SRPPU intercept
Mean (SE)	0.22 (0.30)	24.50* (0.86)	0.24 (0.27)	22.97* (0.85)	-0.01 (0.01)	0.67* (0.09)	0.24 (0.29)	24.23* (0.86)	0.00 (0.37)	1.01* (0.33)
Variance	0.01	4.96*	-0.01	5.66*	0.00	0.07*	-0.00	5.07*	0.02	0.89*
Path estimates										
Age		0.04		0.04 [†]		-0.01 [†]		0.04		-0.01
Average pornography use at baseline		-2.55*		—		—		-2.96*		1.03*
Self-reported problematic use		-0.34 [†]		-0.62*		0.10*		—		—
Moral incongruence		-0.50*		-0.43*		-0.01		-0.65*		0.43*
Religiousness		0.25		-0.06		0.11*		0.30		0.04
Latent factor covariances										
EF intercept		—		—		-0.30*		—		-0.59*

Model 1: $\chi^2 (15) = 21.17, P = .13$; comparative fit index (CFI) = 0.989, Tucker–Lewis index (TLI) = 0.981, robust root mean square error of approximation (RMSEA) = 0.040; standardized root mean square residual (SRMR) = 0.026.

Model 2: $\chi^2 (38) = 47.26, P = .14$; CFI = 0.990, TLI = 0.984, RMSEA = 0.031, SRMR = 0.033.

Model 3: $\chi^2 (38) = 76.67, P < .001$, CFI = 0.972, TLI = 0.955, RMSEA = 0.063, SRMR = 0.031.

All controls (exogenous variables) were allowed to covary, but these results are omitted from results for clarity. Given that the mean and variance of the slopes in all growth curves was insignificant (ie, there was no change over time), intercept-only models were computed for the sake of parsimony.

EF = erectile functioning; LGC = latent growth curve; PU = pornography use; SRPPU = self-reported problematic pornography use.

* $P < .001$.

[†] $P < .05$.

Similarly, we also conditioned a parallel process growth curve model for self-reported problematic use and erectile functioning, again obtaining excellent fit for the model: $\chi^2(38) = 76.67$, $P < .001$, CFI = 0.972, TLI = 0.955, RMSEA = 0.063, SRMR = 0.031. The obtained slope for self-reported problematic pornography use was statistically indistinguishable from 0 (slope = 0.060, $P = .605$; variance = 0.02, $P = .164$), indicating relative stability in self-reported problematic pornography use over a 1-year period. Again, however, whereas average pornography use at baseline did predict the latent intercepts for both variables, given that the mean and variance of the slopes in both curves was insignificant (ie, there was no change over time), an intercept-only model was computed for the sake of parsimony. Collectively, across all 3 models, our results suggest that pornography use and self-reported problems with use have no detectable longitudinal impact on erectile functioning.

DISCUSSION

At the outset of this study, we sought to examine the potential relationships among pornography use, self-reported problems with pornography use, and erectile functioning. To accomplish this goal, we collected data from 3 separate samples: a cross-sectional sample of undergraduate men, a sample of men matched to U.S. demographic norms, and a 12-month longitudinal sample of men recruited via Mechanical Turk. Here we review our findings and discuss the implications of this work.

Pornography Use and Erectile Functioning

In 3 samples of sexually active men who also consume pornography, we found very high levels of erectile functioning (eg, all samples had a slight negative skew, with average functioning >20 on a scale of 5–25), that remained extremely stable over a 1-year period (ie, high correlations over time and a latent growth slope that was statistically indistinguishable from 0). In general, among sexually active pornography-using men, serious erectile problems seem rare, a finding that runs counter to a popular narrative suggesting that pornography use is driving an epidemic of ED. Moreover, given that the medical community has not conclusively found evidence of an increasing rate of ED in young men in recent years, the present work provides additional evidence against the notion that pornography use is driving an epidemic of ED.

Across the 3 samples, we found only very limited support for the notion that mere pornography use itself is related to diminished erectile functioning, which is inconsistent with another popular narrative claiming that such use is likely to drive sexual dysfunction. Although this association was observed in sample 3, it was not replicated in sample 1 or 2. In sample 3, both cross-sectional and longitudinal links between pornography use and erectile functioning were revealed in simple correlations.

Notably, this longitudinal association was of moderate strength in simple correlations but was completely absent in growth curve models, including parallel process models. More to the point, there was no evidence in any sample that mere pornography use is associated with changes in erectile functioning.

Across the 3 samples, we did find consistent support, both cross-sectionally and longitudinally, for the supposition that self-reported feelings of problematic pornography use are associated with ED. Specifically, in both correlational and latent variable analyses, self-reported problematic use of pornography was consistently related to lower levels of self-reported erectile functioning. Moreover, in our longitudinal sample, self-reported problematic pornography use was associated with diminished ED over time in simple correlations. However, LGC models—including parallel process growth curve models—revealed no causal links between self-reported problematic use and erectile functioning. In short, self-reported problematic use of pornography was not associated with changes in erectile functioning over a 1-year period, likely due to the lack of change in erectile functioning in the sample overall.

The pattern of our findings is subject to a number of possible interpretations, however. For example, it is plausible that the emergence of ED in some men, when associated with pornography watching, drives a subjective feeling of problematic pornography use, even if pornography use was not the main cause of the ED. Alternatively, our findings may show that men with erectile functioning issues are more likely to use pornography in ways in which they find problematic. More to the point, given that the links between self-reported problematic use of pornography and erectile functioning emerged only in cross-sectional and correlational analyses (as opposed to LGC models), causal or directional inferences are not implied or even possible.

In addition, we note that in the 1 sample (sample 3) in which pornography use itself was related to diminished erectile functioning cross-sectionally, both self-reported problematic use and moral incongruence regarding pornography use were similarly related to diminished erectile functioning, both of which in addition to the relationship between reported use and diminished erectile functioning. When these findings are considered along with the results from our other 2 samples demonstrating no clear relationship between pornography use and erectile functioning, we urge caution in placing credence on statements of pornography use itself as a causal mechanism in driving ED.

Finally, we note that our work supports previous studies demonstrating that self-reported pornography-related problems are largely independent of pornography use over time. That is, in both parallel process growth curve analyses that we conducted for pornography use and for self-reported problems associated with use, no meaningful change was observed in any variable, and baseline pornography variables were unrelated to any changes in either variable.

Implications

Collectively, our findings are not consistent with a portrayal of pornography as driving an epidemic of ED, nor are they consistent with claims that pornography use is unrelated to erectile functioning altogether. Instead, our findings suggest that men with self-reported problematic patterns of pornography use may be somewhat more likely to also be experiencing ED, and that this association may persist over time, although they are unlikely to be causally linked. Such a contention is consistent with previous work⁶³ specifically associating hypersexuality with some problems in erectile functioning.

In general, these findings are consistent with the greater body of literature noting that self-reported problematic pornography use—regardless of whether it is actually addictive or dysregulated—is associated with indicators of diminished global well-being.^{24,25,47} In addition to diminished mental and social functioning, self-reports of problematic pornography use also correspond to diminished sexual functioning. It is possible that the associations between pornography-watching and ED along with problematic pornography use may be mediated by some other factors, such as decreased mood, depressive symptoms, or increased anxiety and stress,^{37,39,40,85,86} especially given that some of these factors are likely present in individuals with truly dysregulated sexual behaviors and have been identified as libido-diminishing factors in other clinical scenarios.⁸⁷ It is also possible that decreased erectile functioning is strictly context- and situation-related (eg, temporary ED during intercourse after a binge of pornography-watching and masturbation),⁸⁵ which might not be captured by our questionnaire averaging erectile functioning over time.

Limitations and Future Directions

Despite the relative consistency of our findings across diverse samples, generalizations regarding our findings are confined by a few key limitations. Chiefly, the present work relied wholly on self-reported data, the limitations of which are well known.⁸⁸ Given that laboratory-based studies of physiology have called into question the links between pornography use and erectile functioning,⁶⁰ we are hesitant to use self-reported data to dismiss previous findings. More to the point, future work using a variety of methods (ie, partner reports, ecological momentary assessments, and physiological measures) are needed to more carefully evaluate for a true association between self-reported problematic pornography use and real-world ED. Even so, our present work did make use of one of the most widely used and well-validated self-report measures of erectile functioning, as well as a face-valid measure of self-reported problematic pornography use. As such, we do believe that the associations between perceptions of erectile problems and perceptions of pornography-related problems are robust and likely replicable.

It is also plausible that pornography use may be associated with other sexual dysfunctions in men, such as premature

ejaculation or anorgasmia. Similarly, it may be associated with sexual dysfunction in women as well. We did not consider such possibilities, and future work would be wise to do so. In addition, we note that none of our samples was derived from clinical samples of men seeking treatment for either pornography-related problems or erectile functioning issues. It is very possible that the associations documented here may vary in strength or direction in clinical populations. Future work specifically examining clinical populations for both factors (erectile functioning and pornography-related problems) is needed. Moreover, it would be useful to assess erectile functioning separately for solitary and dyadic sexual behaviors, given that dysfunction may be expressed only in one of the contexts. Our present work only assessed men who had been sexually active with a partner within the past year, which may have eliminated men with complete ED (eg, complete inability to engage sexually with a partner). We also note that previous studies have shown that individuals seeking treatment for problematic pornography use experience binge pornography-watching (multiple hours per day) accompanied by multiple masturbations.⁸⁶ Future work should account for such binges as a possible source of ED in dyadic sexual behaviors immediately after such binges. Finally, we note that the present study was confined to U.S. samples. Previous research on problematic pornography use has specifically noted that U.S. samples seem to differ slightly than some international samples, which may limit generalizability cross-culturally.⁴⁷

CONCLUSION

There is growing speculation in nonacademic circles that pornography use may be related to the experience of ED. Alternatively, some previous academic studies have speculated that hypersexuality or dysregulated sexual behavior may be related to such problems. We explored these possible links over 3 studies. In a cross-sectional sample of undergraduate men and a cross-sectional online sample of adult men that were roughly matched to U.S. demographic norms, we found no consistent links between mere pornography use and erectile functioning in partnered sexual activities, although we did find consistent links between self-reported problems with pornography (eg, feelings of compulsivity or addiction) and ED. In a longitudinal sample of men from Mechanical Turk, we found both cross-sectional and longitudinal links between pornography use and self-reported issues with ED using simple correlations; however, subsequent growth curve analyses revealed no links between any baseline pornography variables and the trajectory of erectile functioning over a 1-year period, nor did any pornography-related variables covary with erectile functioning in parallel process LGC analyses. In short, there was consistent evidence across all 3 studies that mere pornography use itself is not associated with ED among males who do not seek treatment for problematic pornography use. Collectively, our data convey strong skepticism regarding the claim that mere pornography use is generally driving an epidemic

of ED. Even so, given the exploratory nature of this work, the exclusive use of self-report measures, and the inconsistent findings across studies, we urge caution in interpreting these results.

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