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What Is the Relationship Between Religiosity, Self-Perceived

Problematic Pornography Use, and Depression Over Time?

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A thesis submitted to the faculty of
Brigham Young University
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Master of Science

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ABSTRACT

What Is the Relationship Between Religiosity, Self-Perceived
Problematic Pornography Use, and Depression Over Time?

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Master of Science

Previous studies suggest that religious individuals are more likely than non-religious individuals to perceive their pornography use as problematic. For our six-month longitudinal study, we recruited a sample of adults from Turkprime.com. We hypothesized that more religious individuals who use pornography at baseline would report higher self-perceived problematic pornography use at three months, which would be associated with higher depression at six months. We constructed and validated our own measure of self-perceived problematic pornography use, which included two factors: excessive pornography use and compulsive pornography use. We ran two separate structural equation models, one with excessive use at three months and the other with compulsive use at three months. Contrary to our hypothesis, religiosity was not related to self-perceived problematic pornography use in any of the models. Both models were moderated by biological sex. For men, religiosity at baseline was associated with increased pornography use at six months. For both men and women, excessive pornography use at three months was associated with increased depression at six months. For men, depression at baseline was associated with self-perceived problematic pornography use at three months. For women, higher self-perceived problematic pornography use at three months predicted lower frequency of pornography use and higher depression at six months. Women's pornography use was more stable over time than men's. Our findings are discussed in light of theories of depression, religious incongruence, and sexual scripts.

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Introduction

Pornography use is common, with recent estimates suggesting that 55-94% of men and

16-67% of women report viewing pornography (Perry & Schleifer, 2017; Wright, Bae, & Funk,

2013; Regnerus, Gordon, & Price, 2016; Træen & Daneback, 2013). Among younger cohorts,

pornography use may be even more common, with 87% of male college students and 31% of

female college students reporting using pornography (Carroll et al., 2008). According to

nationally representative data from 1973 to 2016, the rate of pornography use has increased

among all included groups except for White women (Perry & Schleifer, 2017). In addition to

being common, pornography use is generally viewed neutrally or positively, with more than two-

thirds of male college students and nearly one-half of female college students reporting that

using pornography is acceptable (Carroll et al., 2008).

Outcomes Associated with Pornography Use

Given the commonality of pornography use, understanding its associated outcomes is

important. Research suggests both positive and negative outcomes associated with pornography

use. Some people who use pornography report positive feelings in the moment of watching it,

such as happiness and joy (Peterson & Janssen, 2007; Prause, Staley, & Fong, 2013). In a

representative Danish sample, people who used pornography reported believing that

pornography generally had positive effects in their lives (Hald & Malumuth, 2008). Pornography

use has also been associated with positive outcomes in relationships, such as partners being more

likely to talk with one another about sexual desires and increased sexual satisfaction among

women (Daneback, Traen, & Mansson, 2009; Poulsen, Busby, & Galovan, 2013).

The literature also suggests associations between pornography use and negative outcomes. For instance, some studies suggest that higher pornography use is associated with lower partner satisfaction among men and women (Goldsmith, Dunkley, Dang, & Gorzalka, 2017). In cross-sectional studies of heterosexual couples, male pornography use has been negatively associated with relationship quality reported by female partners and sexual quality reported by both men and their partners (Poulsen et al., 2013; Stewart & Szymanski, 2012). Starting pornography use has been longitudinally associated with increased likelihood of divorce, while stopping pornography use has been associated with decreased likelihood of divorce (Perry & Schleifer, 2018).

Pornography use has been associated with an increased likelihood of depressive symptoms. Women who identify as excessive users of internet pornography and as addicted to sex are more likely to have symptoms of depression, withdrawal, and suicide attempts (Corley & Hook, 2012). Women who perceive that their partners have high rates of pornography use have higher rates of psychological distress (Szymanski, Feltman, & Dunn, 2015). Even nonpathological pornography use has been associated with higher levels of depressive symptoms in multiple populations, including adolescents (Ybarra & Mitchell, 2005), religious individuals (Nelson, Padilla-Walker, & Carroll, 2010), and those who believe that pornography use is morally wrong (Perry, 2017b). Additionally, men who view pornography generally have lower self-esteem and lower satisfaction with their sexual partners (Morrison, Ellis, Morrison, Bearden, & Harriman, 2006).

Some have suggested that depression is related to the development of pathological pornography use (Young & Rogers, 1998). Some evidence suggests that individuals who identify as having a sexual addiction report increased sexual behavior when they feel depressed (Bancroft

& Vukadinovic, 2004). One reason for this may be that people who are depressed tend to watch more pornography in an attempt to improve their mood (Paul & Shim, 2008), or that people who are depressed tend to use pornography as a means of experiential avoidance (Levin, Lillis, & Hayes, 2012). Though depression and pornography use have been associated, it is unclear if depression causes increased pornography use, pornography use causes increased depression, or if some third variable might cause them both.

Though some evidence suggests that pornography use is associated with negative outcomes such as depression, whether or not problematic pornography use should be considered an addiction is debated in the literature. Some have argued that problematic pornography use can be considered an internet sex addiction (e.g., Griffiths, 2012), and others have argued that pornography addiction models have insufficient empirical support (e.g., Ley, Prause, & Finn, 2014; Steele, Staley, Fong, & Prause, 2013). Whether or not pornography should be considered addictive, a significant proportion of people who use pornography, around 5% of women and from 13% to 60% of men, perceive their pornography use as problematic and believe that they are addicted to pornography (Cavaglion, 2008; Cooper, Delmonico, & Burg, 2000; Kraus, Martino, & Potenza, 2016; Ross, Månsson, & Daneback, 2012; Twohig, Crosby, & Cox, 2009).

Self-Perceived Problematic Pornography Use

In recent years, research interest in the potential effects not of pornography use alone, but of the belief that one uses pornography excessively, has increased. Problematic pornography use is a broad construct, which some have defined as spending over a certain number of hours using pornography a week (Cooper, Putnam, Planchon, & Boies, 1999). However, this definition of problematic pornography use does not include individuals who use pornography relatively infrequently, but who interpret their pornography use as problematic and report experiencing

negative outcomes from their pornography use (Nelson et al., 2010; Patterson & Price, 2012). Evidence suggests that self-perceived problematic pornography use as defined by subjective interpretations of pornography use as problematic differs from problematic pornography use as defined by hours of pornography use or by other "objective" criteria (Grubbs, Sessoms, Wheeler, & Volk, 2010). For example, in a cross-sectional study of heterosexual White men, self-report of negative symptoms as a result of pornography was more strongly related to seeking treatment for pornography use than was frequency of pornography use (Gola, Lewczuk, & Skorko, 2016). Because of research evidence suggesting that self-perceived problematic pornography use is a distinct construct from frequency of pornography use and other "objective" criteria, in this study we focus on self-perceived problematic pornography use.

Self-perceived problematic pornography use has been given more specific labels, including perceived addiction (Grubbs et al., 2010). Perceived addiction to pornography occurs when an individual feels that their pornography use is compulsive and that they are addicted to pornography, whether or not he or she displays compulsive behavior patterns and regardless of frequency of pornography use (Grubbs, Volk, Exline, & Pargament, 2015; Grubbs, Stauner, Exline, Pargament, & Lindberg, 2015). Perceived addiction is composed of three domains, namely: perceived compulsivity, access efforts, and emotional distress (Grubbs, Volk, et al., 2015). Perceived compulsivity is the feeling of being unable to control pornography use. Access efforts are the extent to which a person feels that pornography is interfering with his or her daily life because of efforts that the person has been willing to do to obtain pornography. Emotional distress is feeling guilt, shame, and regret regarding pornography use (Grubbs, Volk, et al.). Because we are most interested in feelings of being unable to control pornography use and because the archival data that we used contained questions that appeared most relevant to

perceived compulsivity, in this study, we focus on perceived compulsivity as a measure of self-perceived problematic pornography use.

Research suggests that perceived addiction to pornography is related to multiple negative outcomes, including sexual dissatisfaction (Blais-Lecours, Vaillancourt-Morel, Sabourin, & Godbout, 2016), low self-esteem (Wilt, Cooper, Grubbs, Exline, & Pargament, 2016), and distress (Bradley, Grubbs, Uzdavines, Exline, & Pargament, 2016). Grubbs, Stauner, and colleagues (2015) found a robust relationship between perceived addiction and aggregate distress when average hours of daily pornography use, neuroticism, and socially desirable responding were controlled. They also found that perceived Internet pornography addiction mediated the relationship between pornography use and distress. In other words, psychological distress may not directly occur as a result of pornography use, but as a result of attitudes towards pornography use. Multiple studies support the finding that perceived addiction to pornography is related to psychological distress (Bradley et al., 2016). In addition, perceived addiction is associated with religiosity, with more religious people being more likely to perceive themselves as addicted to pornography (Bradley et al., 2016; Grubbs, Exline, Pargament, Hook, & Carlisle, 2015; Wilt et al., 2016).

Religiosity and Pornography Use

Religion often plays an important role in developing attitudes and moral beliefs about pornography. Generally, organized religions endorse conservative views regarding sexuality, which likely lead to negative attitudes regarding pornography use (Patterson & Price, 2012; Sherkat & Ellison, 1997). Drawing on insight from religious incongruence theory, Perry (2017b) found that individuals who are more religious are also more likely to believe that pornography is always morally wrong. However, 10% of these individuals view pornography despite that belief

(Perry, 2017b). The largely negative view that religious individuals hold towards pornography may be what contributes to the negative outcomes that they experience in their pornography use. Additional studies have suggested that while reported pornography consumption is correlated with lower levels of reported happiness for nonreligious individuals, the relationship between pornography consumption and lower happiness is the strongest among those who regularly attend a religious denomination with strong attitudes against the use of pornography (Patterson & Price, 2012). This relationship between church attendance, pornography use, and happiness is similar for both men and women (Patterson & Price, 2012). In addition, religious individuals who view pornography are at greater risk of experiencing perceived addiction than their nonreligious counterparts (Grubbs, Exline et al., 2015).

In a cross-sectional study, Grubbs, Exline, and colleagues (2015) examined the effects of moral disapproval of pornography use, religious beliefs, and their relation to perceived pornography addiction. The study compared religious and non-religious individuals with results indicating that perceived addiction was significantly more likely among the religious group even when the frequency of use was controlled (Grubbs, Exline et al., 2015). These results give evidence that, while religious people may be viewing pornography less frequently than other groups, they are more likely to believe that they are addicted. Additional results from the Grubbs et al. (2015) study suggest that the relationship between perceived addiction and religion was not direct, but was mediated by the moral disapproval that religious individuals held towards pornography use.

Research done by Bradley and colleagues (2016) indicates that moral disapproval of pornography leads individuals with greater belief in God to have a greater perception of pornography addiction (Bradley et al., 2016). Further results of the study indicated that greater

perception of addiction, but not necessarily religiosity, was associated with higher levels of psychological distress (Bradley et al., 2016). This suggests that perceived addiction, not necessarily incongruence in religious beliefs and practices, leads to psychological distress. These findings may further explain why Perry (2017b) found that men who believe viewing pornography to always be morally wrong, but watch it regardless, were more likely to experience depressive symptoms; the strong religious and moral stances of these individuals against pornography were related to greater perceived addiction and to heightened psychological distress.

Perceived addiction has been connected to lower levels of self-esteem, greater levels of anger, including anger towards God, depression, and increased feelings of general distress (Wilt et al., 2016). Psychological distress combined with continued pornography use often, but not always, results in diminished religious practice (Perry 2017a). In fact, longitudinal effects of pornography use among religious individuals vary, with some experiencing diminished religious practice and others experiencing increased religiosity (Perry, 2017a). Reasons behind these findings are unclear. Perhaps, the increased stimulation of religious practice is an attempt to overcome or even compensate for pornography usage. On the other hand, diminished religiousness is perhaps an attempt to remove moral incongruence.

The Current Study

Pornography use is becoming ever more popular. While many individuals experience benefits from viewing pornography (Hald & Malumuth, 2008), religious individuals tend to experience more negative effects related to pornography use, such as decreased emotional stability and decreased spirituality practices (Bradley et al., 2016; Perry, 2017a). Negative outcomes may result from an individual's perception that their pornography use is problematic.

While previous research has examined the relationships between religiosity, self-perceived problematic pornography use, and depression cross-sectionally, we know of no research that has examined the relationship between religiosity, self-perceived problematic pornography use, and depression over time. We hypothesize that individuals who are more religious and who use pornography at baseline will have greater perceptions of problematic pornography use three months later. We also hypothesize that self-perceived problematic pornography use at three months will be associated with depression at six months.

Methods

This study was pre-registered with the Open Science Framework (OSF). The pre-registration, dataset, and code for our analysis in Stata can be found at https://osf.io/hyufd/.

Participants

The data that we used for this study were initially collected to develop the Pornography Consumption Scale (Hatch, Esplin, & Braithwaite, 2019), a new measure of pornography consumption. Participants for our study were recruited from MTurk via turkprime.com. To be eligible for the study, participants must have first agreed to the turkprime.com terms of service. Those who selected our study were redirected to a Qualtrics.com survey where they were provided with our Institutional-Review-Board-approved informed consent documents prior to data collection. From this point participants were free to consent or withdraw from the study. Individuals younger than 18 years of age were excluded from the study. In order to recruit individuals for the study, participants received monetary payments for each survey completed and were entered to win Amazon.com gift certificates six times, once after each follow-up survey. The study spanned six months with surveys sent out to participants every 30 days after the initial recruitment survey.

Our sample consisted of 320 adult individuals at baseline, 175 at the three-month time point, and 163 at the six-month time point. The initial 320-person sample was 45.3% female, 54.8% male, 74.7% White, 10.1% African American, 5.5% Asian, 5.5% Latino, 1.3% Biracial, and 1.3% identified as other. Ages ranged from 19 years to 75 years old with a mean age of 36.26 years and a standard deviation of 10.18 years. The sexual orientation of the group was self-identified as 86% heterosexual, 2.9% homosexual, 10.1% bisexual, and .91% other. Education levels ranged from less than a high school degree to graduate or professional degree; 0.03% receiving less than a high school diploma, 9.4% had a high school diploma or equivalent, 34.2% had some college but no degree, 37.7% received a bachelor's degree, and 8.2% had a graduate or professional degree.

Measures

Depression. In order to measure depression, we used the Center for Epidemiologic Studies Depression Scale Revised (CESD-R-10). The CSED-R-10 is a psychometrically sound 10-item self-report measure with an internal consistency of 0.86 (Björgvinsson, Kertz, Bigda-Peyton, McCoy, & Aderka, 2013; Miller, Anton, & Townson, 2008) and test-retest reliability of .85 (Björgvinsson et al., 2013; Miller et al., 2008). The CESD-R-10 also has high convergent validity with other measures of depression ($r = .86$, $p < .001$ with the BASIS-24–Depression and Functioning subscale), and divergent validity with non-depressive scales ($r = .46$, $p < .001$ with the Penn State Worry Questionnaire–Abbreviated; $r = -.23$, $p < .001$ with the Emotion Regulation Questionnaire; Björgvinsson et al., 2013). Per CESD-R-10 procedures, we created an index for depression by calculating the arithmetic mean of each individual's answers to the 10 questions of the CESD-R-10.

Religiosity. Because we used archival data that did not contain an established measure of religiosity, we created our own measure of religiosity using three questions, each rated on a 7-point Likert-type scale from 0 to 6. The first question is "How strongly do you believe in God (Allah, Jahwe…)?" with "0" indicating *certain that God does not exist* and with "6" indicating *certain that God exists*. The second question is "How religious are you?" with "0" indicating *not at all religious*. The third question is "How often do you pray?" with "0" indicating *almost never* and "6" indicating *daily*. We conducted an exploratory factor analysis (EFA) of these questions at baseline. Both Barlett's test of sphericity ($p < .001$) and the Kaiser-Meyer-Olkin test of sampling adequacy (KMO = .76) suggested that the data were appropriate for EFA. From the EFA we extracted one factor that we named Religiosity, with an Eigenvalue of 2.39. The three questions loaded well onto the Religiosity factor, with all standardized factor loadings above .87. We then conducted a confirmatory factor analysis (CFA) of the religiosity questions at the three-month time point, which had excellent model fit (χ_2 (0) > .001, p > .001; RMSEA < .001; CFI = 1.0). The standardized factor loadings of all religiosity questions at the three-month time point were above .89. Cronbach's alpha of the three religiosity questions was .92 at baseline and .94 at three months.

Constructing a measure self-perceived problematic pornography use. Because we used archival data that did not contain an established measure of self-perceived problematic pornography use, we created our own measure of self-perceived problematic pornography use. Because this group of questions had not previously been used together, we used an exploratory factor analysis with baseline data, followed by a confirmatory factor analysis of data from the three-month time point to see if the factor structure from baseline would generalize to another time point. All of our measurement operations for how to define this construct were settled

before we tested our hypothesis. Items we included in our preliminary psychometric analyses are listed below.

We included the Excessive Use Subscale of the Problematic Pornography Use Scale (Kor et al., 2014), which includes three items, each rated on a six-point Likert-type scale from *never true* to *almost always true*. The three items are: "I spend too much time being involved in thoughts about pornography;" "I spend too much time planning to and using pornography;" and "I often think about pornography".

We also included items that we created. We used the items "I feel like pornography is addictive" and "I can stop viewing porn whenever I would like," each rated on a five-point Likert-type scale from *strongly disagree* to *strongly agree*. We included the item "I view pornography too often" rated on a seven-point Likert-type scale from *strongly disagree* to *strongly agree*. We also includes the items "I spend too much time being involved in thoughts about pornography" and "I spend too much time planning to and using pornography," each rated on a six-point Likert-type scale from *never true* to *almost always true*. We also included the items "For each of the following items, select the answer that best describes how you feel about viewing pornography." Each question is on a 5-point semantic differential scale from *Bad* to *Good*, from *Unpleasant* to *Pleasant*, from *Negative* to *Positive*, from *Unsatisfying* to *Satisfying*, and from *Worthless* to *Valuable*. We also included the items "Have you ever paid for pornography?" and "I have lied about using pornography," each scored as *yes* or *no*.

From the exploratory factor analysis, we extracted two factors, which we named Emotional Response to Pornography (Eigenvalue = 3.92) and Compulsive Behaviors and Thoughts about Pornography (Eigenvalue = 2.82). All other factors had an Eigenvalue of less than 0.5. The five items about "how you feel about viewing pornography" loaded well onto the

Emotional Response Factor, with factor loadings ranging from .78 to .90, while the items "I

spend too much time being involved in thoughts about pornography;" "I spend too much time

planning to and using pornography;" "I often think about pornography;" "I feel like pornography

is addictive;" "I can stop viewing porn whenever I would like;" and "I view pornography too

often" loaded well onto the Compulsive Behaviors and Thoughts Factor, with factor loadings

ranging from an absolute value of .49 to .86 (see Table 1 for all standardized factor loadings).

Table 1
Exploratory Factor Analysis Results for Baseline Self-Perceived Problematic Pornography Use

	Standardized Factor Loadings	
Item	Emotional Response	Compulsive Behaviors and Thoughts
I spend too much time being involved in thoughts about pornography	.01	**.82**
I spend too much time planning to and using pornography	.04	**.86**
I often think about pornography	.21	**.75**
I feel like pornography is addictive	-.13	**.49**
I can stop viewing porn whenever I would like	.12	**-.50**
I view pornography too often	.06	**-.58**
I feel bad/good about viewing pornography	**.89**	-.09
I feel unpleasant/pleasant about viewing pornography	**.85**	-.01
I feel negative/positive about viewing pornography	**.90**	-.04
I feel unsatisfied/satisfied about viewing pornography	**.79**	.02
I feel viewing pornography is worthless/valuable	**.78**	.04
I have lied about using pornography	-.03	-.30
Have you ever paid to use pornography?	-.23	-.21

Note: Factor loadings with an absolute value above .40 appear in bold.

We excluded the items "Have you ever paid for pornography?" and "I have lied about

viewing pornography" from further analyses because both items loaded poorly onto both factors

with loadings with absolute values ranging from .03 to .30. We applied an oblique rotation in

order to allow the factors to correlate with each other. The Compulsive Behaviors and Thoughts

Factor and the Emotional Response Factor had a small correlation ($r = .11$).

Table 2
Confirmatory Factor Analysis Results for Self-Perceived Problematic
Pornography Use at Three Months

Item	Excessive Use	Compulsive Use
I spend too much time being involved in thoughts about pornography	.90 (.02)	
I spend too much time planning to and using pornography	.89 (.02)	
I often think about pornography	.85 (.03)	
I feel like pornography is addictive		.58 (.06)
I can stop viewing porn whenever I would like		-.64 (.06)
I view pornography too often		-.80 (.05)

Note: Standardized factor loadings are reported, with standard errors in parenthesis.

In order to see if the factor structure for self-perceived problematic pornography use at

baseline would generalize to another time point, we conducted a confirmatory factor analysis

(CFA) of data from the three-month time point. Initial model fit for the CFA was mediocre (χ^2

(43) = 98.42, $p < .001$; RMSEA = .09; CFI = .96). In order to improve model fit, we removed

two items, "I feel like pornography is addictive" and "I can stop viewing porn whenever I would

like," which had standardized factor loadings of less than .6, after which model fit remained

mediocre (χ^2 (26) = 55.30, $p = .001$; RMSEA = .09; CFI = .97). We then changed the model to a

three-factor model by splitting the Compulsive Behaviors and Thoughts Factor into two factors,

namely: Excessive Use, with the items from the Excessive Use Subscale of the Problematic

Pornography Use Scale (Kor et al., 2014), and Compulsive Use, with the items, "I feel like

pornography is addictive;" "I can stop viewing porn whenever I would like;" and "I view

pornography too often". The three-factor model at three months had improved fit (χ^2 (41) =

76.18, $p = .001$; RMSEA = .075; CFI = .97). Because we suspected the Emotional Response

Factor would have high multicollinearity with depression and because we were more interested

in the behavioral and cognitive components of self-perceived problematic pornography use than its emotional components, we removed the Emotional Response Factor. The two factor model with Excessive Use and Compulsive Use had excellent fit. Therefore, we used this model in our final analyses (χ^2 (8) = 3.34, p = .91; RMSEA < .001; CFI = 1.00).

Pornography use. In order to measure frequency of pornography use, we used the frequency subscale of the Pornography Consumption Scale (Hatch et al., 2019). The frequency subscale contains four items. The items, "How many times have you viewed pornography today?" "How often have you viewed pornography in the past 30 days?" and "How often have you viewed pornography in the past year?" are rated on a 7-point Likert-type scale, while the item "How often have you viewed pornography in the past 7 days?" is rated on a 5-point Likert-type scale. As per the procedures of the frequency subscale of the Pornography Consumption Scale (Hatch et al., 2019), we created an index for pornography use by calculating the arithmetic mean of each individual's answers to the five questions of the frequency subscale.

Biological sex. In order to measure biological sex, we used the question, "What is your biological sex?" dummy coded with "0" representing *Male* and "1" representing *Female*.

Data Cleaning

Excluded data. Seven individuals were excluded from data analysis for answering the survey more than once at a single time point.

Outliers. Values that fell beyond the median plus or minus two standard deviations were considered outliers. There were 19 univariate outliers, one in baseline depression, 15 in baseline pornography use, two in three-month excessive pornography use, and one in six-month pornography use. Outliers that were within the range of possible values for a given measure were

fenced to plus or minus two interquartile ranges from the median. No bivariate outliers were found.

Missing data. We tested the pattern of missingness by creating a dummy variable for missingness and testing whether missingness of each measure was correlated with other independent or dependent variables. For baseline depression, 6.1% of data were missing. 53% of data were missing for six-month depression, 1.3% of data were missing for baseline religiosity, 26% for baseline pornography use, 49% for three-month excessive use, and 50.3% for three-month compulsive use. For six-month depression and six-month pornography use, missingness was not significantly correlated with other variables. To test whether pornography use at six months and depression at six months might be missing completely at random (MCAR), we conducted Little's Test of Missing Completely at Random (Little, 1988), which failed to reject the null hypothesis that depression at six months ($\chi^2(67) = 62.87$, $p > .05$) and pornography use at six months ($\chi^2(39) = 40.07$, $p > .05$) are MCAR.

Missingness in baseline religiosity was significantly correlated with baseline pornography use ($r = .44$, $p < .05$), making baseline religiosity missing at random (MAR). Missingness in baseline pornography use was significantly correlated with scores on baseline depression ($r = -.12$, $p < .05$), making baseline pornography use MAR. Missingness in baseline depression was significantly correlated with the interaction of baseline pornography use and baseline religiosity ($r = .19$, $p < .05$), making baseline depression MAR. Missingness in three-month excessive use was significantly correlated with baseline depression ($r = .12$, $p < .05$), making three-month excessive use MAR. Missingness in three-month compulsive use was significantly correlated with three-month excessive use ($r = .18$, $p < .05$), making three-month compulsive use MAR. Because the data were likely missing completely at random (MCAR) or

missing at random (MAR) with a large amount of missing data, we used the full-information

maximum likelihood (FIML) approach to impute missing data.

Assumptions of normality. We used the mvtest normality command in Stata to look at

the normality of our measures. Six-month depression, baseline pornography use, six-month

pornography use, and three-month Compulsive Use met assumptions of normality ($p > .05$).

Because baseline religiosity did not meet assumptions of normality with respect to kurtosis ($p <$

.0001), we used the Tukey's ladder command in Stata to determine which transformation best

met assumptions of normality. However, no transformation made baseline religiosity meet

assumptions of normality, probably because it is a bimodal distribution. Likewise, three-month

excessive use did not meet assumptions of normality with respect to skewness, and no

transformation brought it within acceptable levels. Baseline depression did not meet assumptions

of normality with respect to skewness ($p = .01$), so the log transformation was used. The

transformed version of baseline depression was used in all further analyses.

Data Analysis

We conducted a structural equation model using data from three time points (baseline,

three-month, and six-month). Because our confirmatory factor analyses suggested that self-

perceived compulsive pornography use and self-perceived excessive pornography use are two

distinct factors in our sample, we conducted two separate structural equation models, one with

compulsive use at Time 2, and one with excessive use at Time 2. In both models, pornography

use, religiosity, the interaction between religiosity and pornography use, and depression from

baseline were used for the first time point. In both models, for the third time point, we included

pornography use and depression from the six-month time point. In one model, we included

excessive use from the three-month time point at time two, and in the other model we included

compulsive use from the three-month time point at time two (see Figure 1 and Figure 2 for our

models).
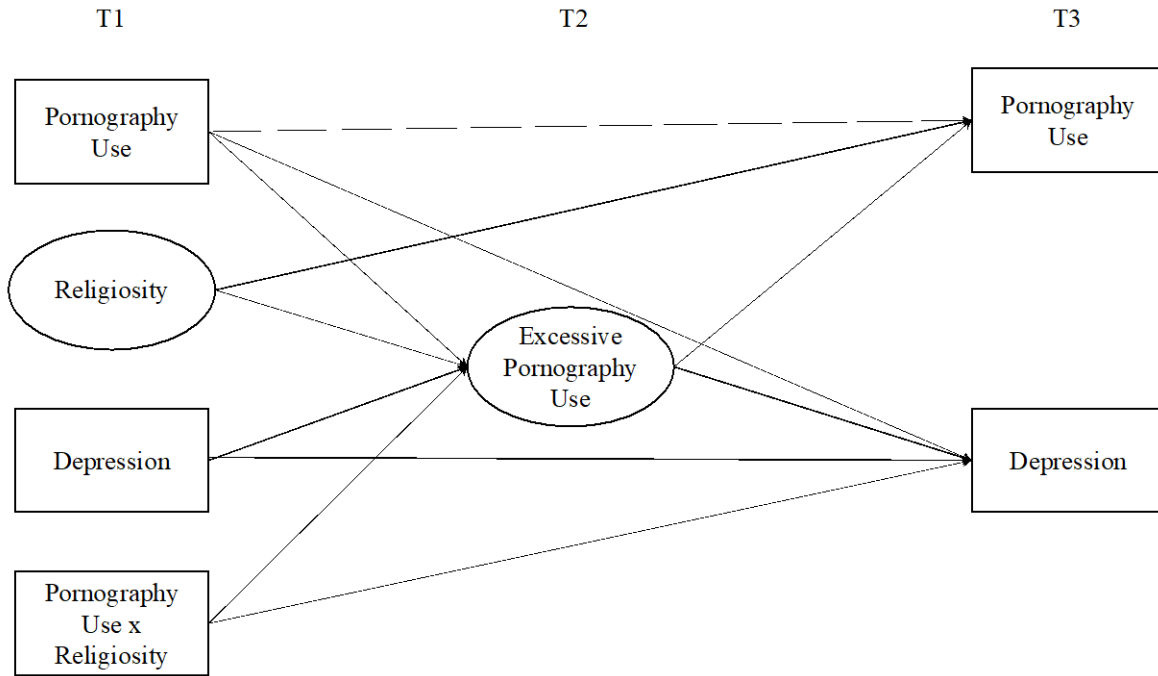
Figure 1. Model of the hypothesized relationships between variables, with self-perceived excessive pornography use at time two.
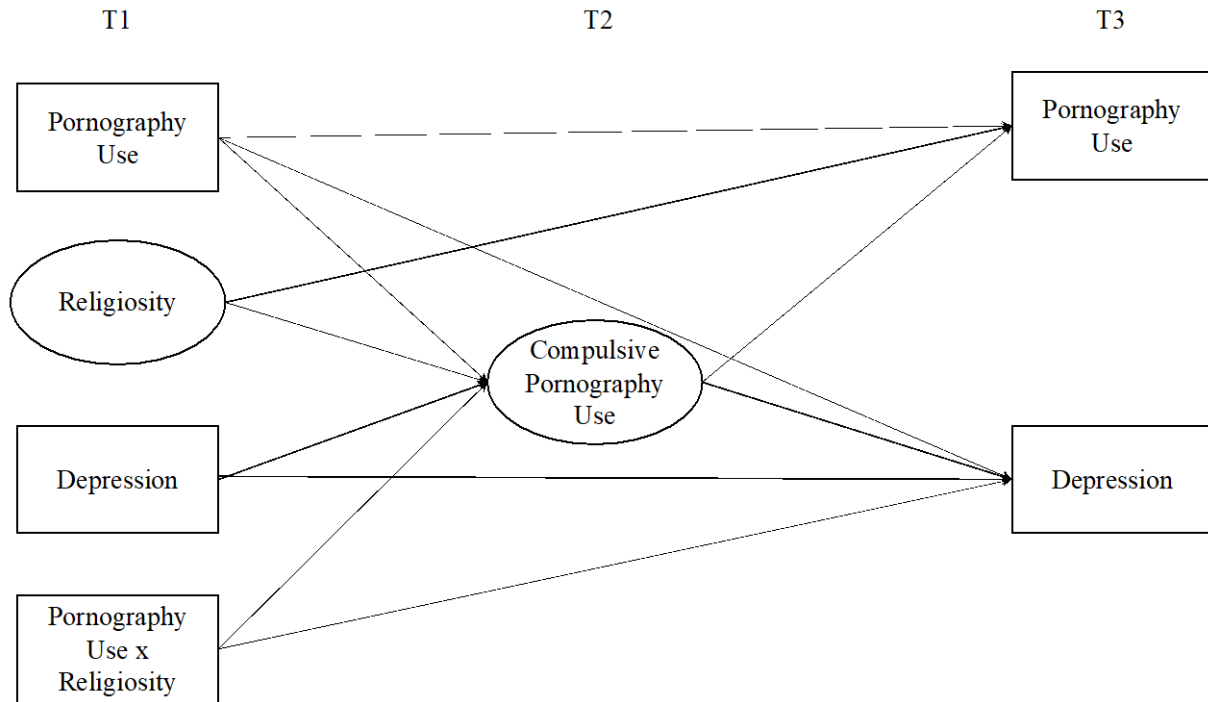
Figure 2. Model of the hypothesized relationships between variables, with self-perceived compulsive pornography use at time two.

Table 3
Standardized Measurement Coefficients for Religiosity in Structural Equation Models

Item	Male Excessive Use	Female Excessive Use	Male Compulsive Use	Female Compulsive Use
How strongly do you believe in God?	.89 (.02)	.90 (.02)	.88 (.02)	.90 (.02)
How religious are you?	.87 (.02)	.91 (.02)	.87 (.02)	.91 (.02)
How often do you pray?	.88 (.02)	.90 (.02)	.88 (.02)	.90 (.02)

Note: Standard errors are in parenthesis.

Table 4
*Standardized Measurement Coefficients for Self-Perceived Problematic
Pornography Use in Structural Equation Models*

Item	Excessive Use		Compulsive Use	
	Male	Female	Male	Female
I spend too much time being involved in thoughts about pornography	.88 (.03)	.82 (.04)		
I spend too much time planning to and using pornography	.88 (.03)	.96 (.02)		
I often think about pornography	.85 (.03)	.94 (.02)		
I feel like pornography is addictive			.66 (.08)	.41 (.07)
I can stop viewing porn whenever I would like			-.59 (.07)	-.58 (.08)
I view pornography too often			-.89 (.06)	-.74 (.08)

Note: Standard errors are in parenthesis.

Because the literature suggests that rates of pornography use differ by biological sex

(Perry & Schleifer, 2017; Wright et al., 2013; Træen & Daneback, 2013) and that biological sex

is a robust moderator of some pornography outcomes (Corley & Hook, 2012; Morrison et al.,

2006), we conducted a test for biological sex moderation with both our analyses by running a

model with all parameters constrained by biological sex, running an otherwise identical model

with all parameters unconstrained by biological sex, and then using the Chi-Square Difference

Test to see if model fit was significantly better for the unconstrained model. Because we

hypothesized that the structural coefficients of the model would have meaningful differences by

biological sex, we then ran a model with structural coefficients constrained by biological sex,

then an otherwise identical model with structural coefficients unconstrained by biological sex. In

order to make the model with constrained structural coefficients converge, we also constrained

the mean score of baseline religiosity by biological sex. We then used the Chi-Square Difference

Test to see if model fit was significantly better for the unconstrained model. All analyses were

conducted with Stata 15.0.

Results

Baseline scores on depression were low for both males (M = .64, SD = .26) and females

(M = .69, SD = .26). At six months, depression scores were relatively higher for both males (M =

1.95, SD = .53) and females (M = 1.93, SD = .52), but were still low compared to suggested cut-

off scores for depression that range from 8 to 15 (Andersen, Malmgren, Carter, & Patrick, 1994;

Björgvinsson et al., 2012). This sample was, on average, not very depressed and should be

considered a community sample, rather than a psychiatric sample (see Table 5 for descriptive

data for all variables, disaggregated by biological sex). Religiosity at baseline was roughly in the

middle of our scale for both men (M = 3.20, SD = 1.95) and women (M = 4.03, SD =2.16), but

the distribution appeared to be bimodal, with many people reporting low religiosity, many

reporting high religiosity, and few in between (see Figure 7 for a histogram). Frequency of

pornography use was relatively high in this sample for both males (M = 3.99, SD = .79 at

baseline; M = 4.11, SD = .74 at six months) and females (M = 4.33, SD = 1.03 at baseline; M =

4.3, SD = 1.03 at six months).
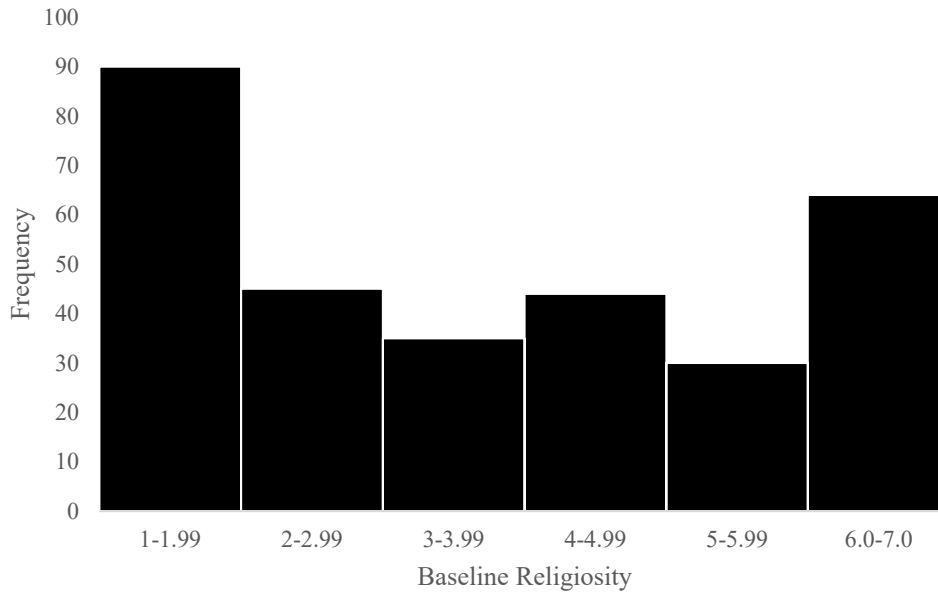
Figure 3. Histogram showing the distribution of religiosity scores at baseline.

Table 5

Descriptive Data for Variables Included in Structural Equation Models

Variable	Male			Female		
	n	*M*	*SD*	*n*	*M*	*SD*
Baseline frequency of pornography use	130	3.99	.79	101	4.33	1.03
Baseline religiosity	169	3.20	1.95	139	4.03	2.16
Baseline depression	160	.64	.26	133	.69	.26
Three-month self-perceived excessive pornography use	86	2.40	1.13	73	1.70	.88
Three-month self-perceived compulsive pornography use	82	3.83	.71	73	4.34	.70
Six-month frequency of pornography use	64	4.11	.74	46	4.33	1.03
Six-month depression	76	1.95	.53	69	1.93	.52

Does Biological Sex Moderate the Models?

For the excessive use model (see Figure 3 and Figure 4), model fit was poor when all parameters we constrained to be the same based on biological sex ($\chi^2(109) = 284.57$, $p < .001$; RMSEA $= .10$; CFI $= .91$). When all parameters were unconstrained by biological sex, model fit was excellent ($\chi^2(73) = 88.64$, $p = .10$; RMSEA $= .04$; CFI $= .99$). Likewise, for the compulsive use model (see Figure 5 and Figure 6), model fit was poor when all parameters were constrained by biological sex ($\chi^2(109) = 247.15$, $p < .001$; RMSEA $= .09$; CFI $= .91$), but was excellent when all parameters were unconstrained by biological sex ($\chi^2(73) = 89.38$, $p = .09$; RMSEA $= .04$; CFI $= .99$). For both the excessive use model and the compulsive use model, the Chi Square Difference Test suggested that the unconstrained models fit the data significantly better than the models that were constrained by biological sex ($p < .0001$).

Figure 4. Excessive pornography use at three months, structural equation model standardized results for males.

See Table 3 for religiosity measurement coefficients and Table 4 for excessive pornography use measurement coefficients.
* $p < .05$
** $p < .01$
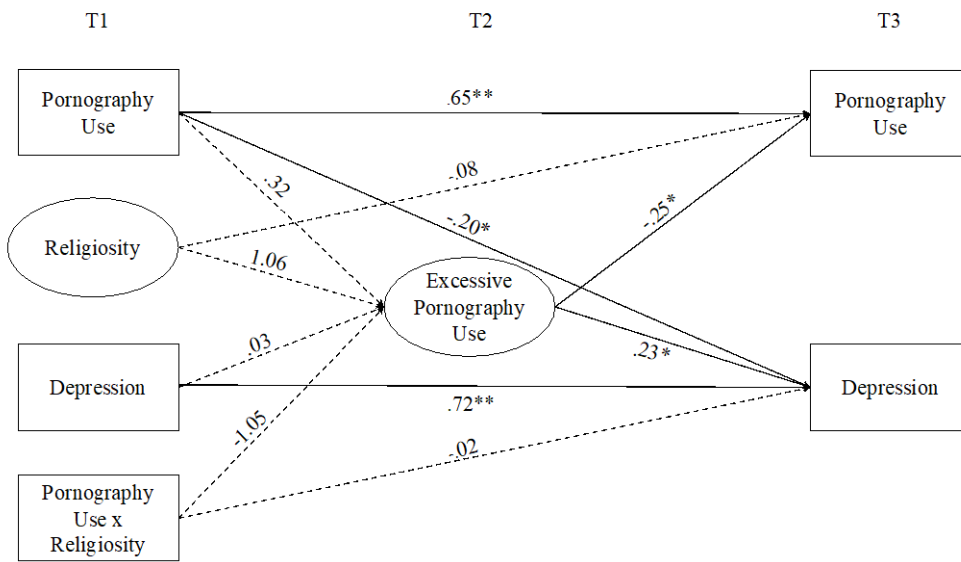
Figure 5. Excessive pornography use at three months, structural equation model standardized results for females.

See Table 3 for religiosity measurement coefficients and Table 4 for excessive pornography use measurement coefficients.
* *p* < . 05
** *p* < .01
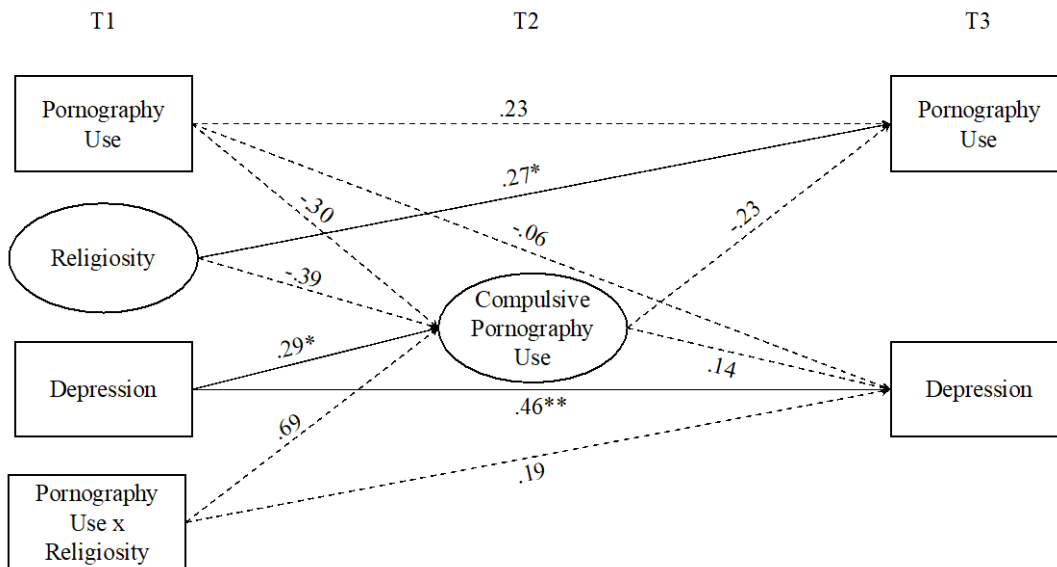
Figure 6. Compulsive pornography use at three months, structural equation model standardized results for males.

See Table 3 for religiosity measurement coefficients and Table 4 for compulsive pornography use measurement coefficients.
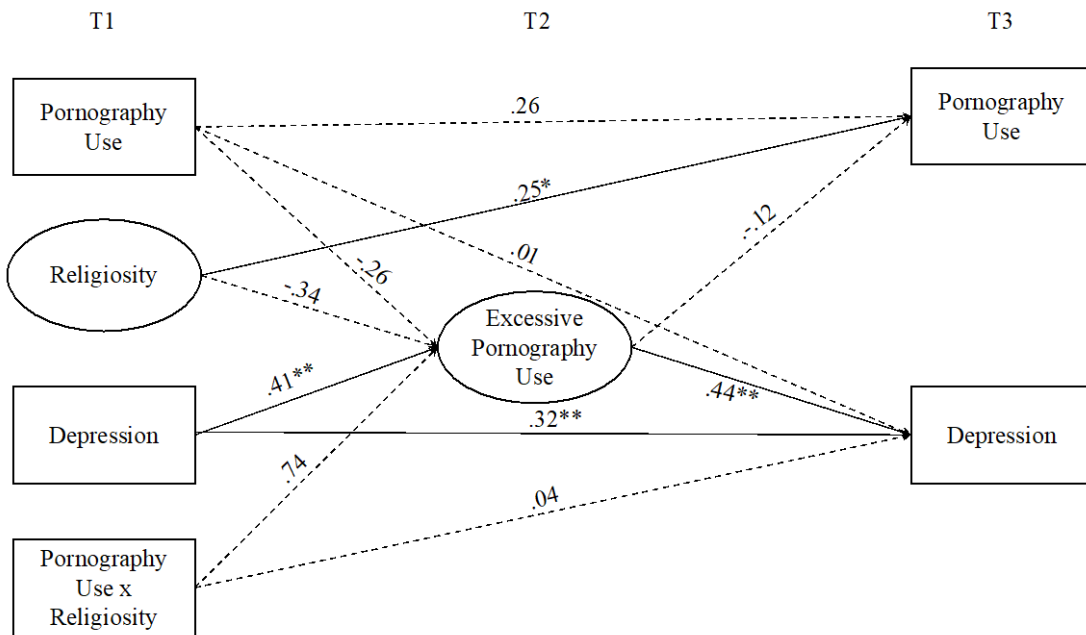* *p* < . 05
** *p* < .01
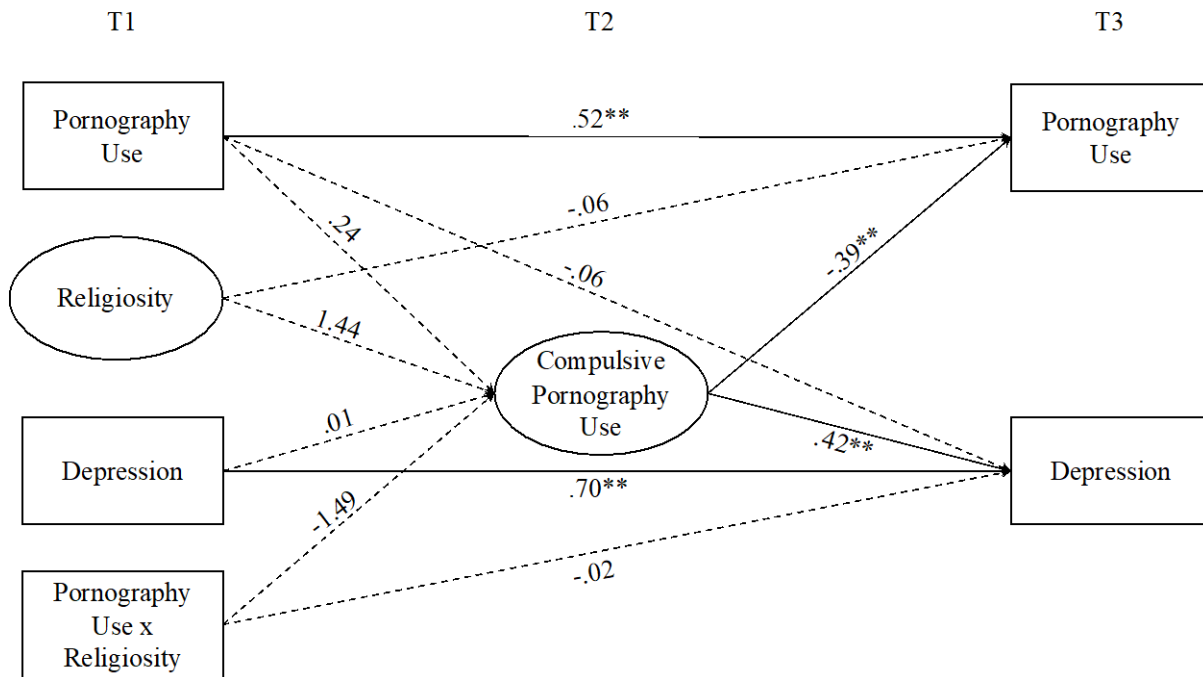
Figure 7. Compulsive pornography use at three months, structural equation model standardized results for females.

See Table 3 for religiosity measurement coefficients and Table 4 for compulsive pornography use measurement coefficients.
* *p* < . 05
** *p* < .01

When structural coefficients were constrained by biological sex, model fit was mediocre in the excessive use model ($\chi^2(78) = 130.92$, *p* < .001; RMSEA = .07; CFI = .97) and in the compulsive use model ($\chi^2(78) = 129.52$, *p* < .001; RMSEA = .07; CFI = .97). The Chi-Square Difference Test suggested that the models with unconstrained structural coefficients fit the data significantly better than the models with constrained structural coefficients (*p* < .0001). We therefore conclude that biological sex is a moderator of both the excessive use and compulsive use models and report the results of the models that were unconstrained by biological sex.

What Is the Relationship Between Religiosity and Self-

Perceived Problematic Pornography Use?

Religiosity at baseline did not predict excessive pornography use at three months for males (β = -.34, 95% CI [-1.04, 0.36]) or for females (β = 1.06, 95% CI [-1.76, 3.87]). Likewise, religiosity at baseline did not predict compulsive pornography use at three months for males (β = -.39, 95% CI [-1.19, 0.42]) or for females (β = 1.44, 95% CI [-1.74, 4.61]). The interaction between religiosity and frequency of pornography use did not predict excessive pornography use at three months for males (β = .74, 95% CI [-.04, 1.53]) or females (β = -1.05, 95% CI [-4.24, 2.14]), and also did not predict compulsive pornography use at three months for males (β = .69, 95% CI [-.23, 1.61]) or females (β = -1.49, 95% CI [-5.01, 2.13]). Neither religiosity nor the interaction between religiosity and frequency of pornography use predicted self-perceived problematic pornography in any of the models.

Though religiosity did not predict self-perceived problematic pornography use, religiosity did predict frequency of pornography use for males. Religiosity at baseline predicted frequency of pornography use at six months for males in both the excessive use model (β = .25, 95% CI [.01, .48]) and the compulsive use model (β = .27, 95% CI [.06, .49]). For females, religiosity at baseline did not predict frequency of pornography use at six months in either the excessive use model (β = -.08, 95% CI [-.31, .15]) or the compulsive use model (β = -.06, 95% CI [-.29, .17]).

What Is the Relationship Between Depression and Self-Perceived

Problematic Pornography Use?

For males in the excessive use model, baseline depression predicted self-perceived excessive pornography use at three months (β = .41, 95% CI [.15, .72]). Excessive pornography use at three months predicted depression at six months for males (β = .44, 95% CI [.15, .73]). For

males in the compulsive use model, baseline depression predicted self-perceived compulsive pornography use at three months (β = .29, 95% CI [.06, .51]). However, compulsive pornography use at three months did not predict depression at six months for males (β = .14, 95% CI [-.15, .42]). Males who were more depressed at baseline were more likely to report higher self-perceived problematic pornography use at three months. In the excessive use model, but not the compulsive use model, self-perceived problematic pornography use at three months predicted depressive symptoms at six months.

For females, baseline depression did not predict self-perceived excessive pornography use at three months (β = .03, 95% CI [-.22, .27]) or self-perceived compulsive pornography use at three months (β = .01, 95% CI [-.28, .30]). For females, excessive pornography use at three months predicted frequency of pornography use at six months (β = -.25, 95% CI [-.50, -.01]) and depression at six months (β = .23, 95% CI [.06, .41]). Likewise, for females, compulsive pornography use at three months predicted frequency of pornography use at six months (β = -.39, 95% CI [-.68, -.10]) and depression at six months (β = .42, 95% CI [.19, .66]). Females who were more depressed at baseline were not significantly more likely to report self-perceived problematic pornography use at three months. However, females who reported higher self-perceived problematic pornography use at three months reported more depressive symptoms at six months.

Depression at baseline predicted depression at six months for females in the excessive use (β = .72, 95% CI [.60, .83]) and compulsive use models (β = .70, 95% CI [.56, .84]) and males in the excessive use (β = .32, 95% CI [.09, .54]) and compulsive use models (β = .46, 95% CI [.26, .65]). Depression was significantly more stable over time for females than for males in

the excessive use model ($\chi^2(1) = 7.51$, $p = .006$), but not in the compulsive use model ($\chi^2(1) =$ 2.739, $p > .05$).

Frequency of Pornography Use Over Time

In the excessive use model for females, baseline frequency of pornography use predicted depression at six months ($\beta = -.20$, 95% CI [-.39, -.01]). However, baseline pornography use did not predict depression at six months for females in the compulsive use model ($\beta = -.056$, 95% CI [-.30, .19]), for males in the excessive use model ($\beta = .01$, 95% CI [-.23, .25]), or for males in the compulsive use model ($\beta = -.06$, 95% CI [-.21, .19]). Baseline frequency of pornography use predicted depression at six months in the excessive use model for females, but not in any other models.

For males, the frequency of pornography at baseline did not predict the frequency of pornography use in either the excessive use model ($\beta = .26$, 95% CI [-.01, .53]) or the compulsive use model ($\beta = .23$, 95% CI [-.04, .50]). However, pornography use at baseline predicted pornography use at six months for females in both the excessive use model ($\beta = .65$, 95% CI [.47, .82]) and the compulsive use model ($\beta = .70$, 95% CI [.56, .84]), and pornography use was significantly more stable for females than for males in the excessive use model ($\chi^2(1) =$ 7.33, $p = .007$), but not in the compulsive use model ($\chi^2(1) = 3.63$, $p = .057$). The frequency of pornography use was not stable over time for males, but it was stable over time for females.

<div align="center">**Discussion**</div>

This study examined the relationships between religiosity, pornography use, depressive symptoms, and self-perceived problematic pornography use, defined here as self-perceived excessive use and self-perceived compulsive use, over six months. We hypothesized that more religious people would be more likely to perceive themselves as using pornography in a

problematic way, and that individuals who reported self-perceived problematic pornography use at three months would report more depressive symptoms at six months.

Religiosity and Self-Perceived Problematic Pornography Use

Neither religiosity nor the interaction between religiosity and pornography use at baseline predicted excessive pornography use or compulsive pornography use at three months. We therefore conclude that, in this sample, more religious people who viewed pornography were about equally as likely as less religious people who viewed pornography to view themselves as using pornography excessively or compulsively. This finding is inconsistent with previous findings that religious individuals are more likely than non-religious individuals to perceive themselves as using pornography excessively or as addicted to pornography (Bradley et al., 2016; Grubbs, Exline et al., 2015).

According to Perry's (2017b) religious incongruence theory, religious people who use pornography experience increased distress related to pornography use and are more likely to view their pornography use as problematic not simply because they are religious, but because they believe that using pornography is morally wrong. It is possible that more religious individuals in our sample did not believe that using pornography is morally wrong, did not experience religious incongruence, and were therefore no more likely than less religious individuals to report self-perceived problematic pornography use. However, the archival data that we used did not contain information about participants' beliefs about whether pornography use is morally acceptable, so this explanation is speculative.

The lack of relationship between religiosity and self-perceived problematic pornography use in our study is surprising. Though we used an ordinal scale of religiosity, the distribution of religiosity in our sample was bimodal (see Figure 7 for a histogram). It is possible that the

bimodal nature of religiosity in this sample influenced our analysis, and that that results would be different in a sample where religiosity followed a normal distribution. In addition, our sample had a higher proportion of sexual minorities (i.e. gay, lesbian, bisexual) than the general population, and there is some evidence that attitudes regarding pornography may be different among sexual minorities than among the general population (Mustanski, Lyons, & Garcia, 2011; Træen & Daneback, 2013). Whatever the reason, for this sample religiosity and self-perceived problematic pornography use were unrelated.

Self-Perceived Problematic Pornography Use and Depressive Symptoms

For males, but not for females, depressive symptoms at baseline predicted excessive pornography use at three months. In other words, men who reported more depressive symptoms at baseline were more likely to use pornography excessively at three months, and then to report more depressive symptoms at six months. This makes temporal precedence of excessive use and depressive symptoms difficult to establish, but it is consistent with research that suggests that self-perceived excessive use of pornography is related to depression (Grubbs, Stauner et al., 2015). The finding that men who reported more depressive symptoms at baseline were more likely to endorse problematic pornography use at three months, and then report more depressive symptoms at six months is consistent with Joiner's theory of depression, which posits that individuals who feel depressed tend to engage in behaviors that perpetuate and even worsen their depression (Joiner & Metalsky, 1995; Joiner, Metalsky, Katz, & Beach, 1999). It is possible that men who have more depressive symptoms are more likely to use pornography in ways that they perceive as problematic, and then to experience increased depressive symptoms as a result.

The relationship between self-perceived problematic pornography use and depressive symptoms was more straightforward in women, as depressive symptoms at baseline did not

predict excessive pornography use or compulsive pornography use at three months. Therefore, our findings suggest temporal precedence of self-perceived problematic pornography use before increased depressive symptoms in women. In other words, women who reported depressive symptoms at baseline were not more or less likely to report self-perceived problematic pornography use at three months, but women who reported higher self-perceived problematic pornography use at three months reported more depressive symptoms at six months. This suggests that women who use pornography in ways that they perceive as problematic do not do so because they already have depressive symptoms. Likewise, excessive pornography use at three months predicted higher depressive symptoms at six months for males, which is consistent with previous findings that feeling that one uses pornography excessively is related to feelings of depression (Corley & Hook, 2012; Grubbs, Stauner et al., 2015; Patterson & Price, 2012; Perry, 2017b).

Self-Perceived Problematic Pornography Use and Frequency of Pornography Use

Women who reported higher self-perceived problematic pornography use at three months reported less pornography use at six months. Self-perceived problematic pornography use did not predict frequency of pornography use in men, which is surprising given previous research that found that self-perceived problematic pornography use predicts increased pornography use over time in adolescent men (Kohut & Štulhofer, 2018). Women who perceived their pornography use to be problematic may have reduced the frequency of their pornography consumption. Though this explanation is speculative, it is in line with sexual script theory, which posits that individuals' sexual behaviors are influenced by scripts or patterns that they have learned from societal norms, media, and personal experiences (Gagnon & Simon, 1973). Sexual scripts can be gendered, with women expected to be generally less sexual than men, more cautious in engaging

in sexual activity, and less interested in pornography (Garcia & Carrigan, 1998; Wiederman, 2005). According to sexual script theory, women who perceive their pornography use as problematic are likely to experience conflict between gendered cultural sexual scripts and their behavior, and may change their behavior to be in line with the cultural sexual script. Gendered sexual scripts might explain why women, but not men, who viewed that their pornography use was problematic reported decreased frequency of pornography use three months later.

Religiosity and Frequency of Pornography Use

Our findings are consistent with other findings that males and females have, on average, different patterns of pornography use. In our sample, religiosity at baseline predicted pornography use six months later for males, but not for females. This suggests that women's pornography use is not affected by their religiosity, while men who were more religious at baseline viewed pornography with greater frequency six months later. This is consistent with research by Perry and Schleifer (2017) that found that pornography use was related to religiosity only for White men, and not for men of color or for women. Interestingly, in our sample, more religious men were more likely to use pornography, while other research has found that more religious men are less likely to view pornography (Perry & Schleifer, 2017; Short, Kasper, & Wetterneck, 2015) or that religiosity is not related to pornography use (Goodson, McCormick, & Evans, 2000). The bivariate correlation between baseline religiosity and frequency of pornography use at six months was positive for males ($r = .21$, see Table 6 for all correlations between variables), suggesting that suppression is an unlikely explanation (Maassen & Bakker, 2001). The reasons why, for men, higher religiosity predicted increased frequency of pornography use are unclear, given that many religions teach against pornography use (Sherkat & Ellison, 1997). One reason for this unanticipated finding may be that our sample had a larger

proportion of sexual minorities than the general population, and that the relationship of

religiosity and pornography use among sexual minorities has not, to our knowledge, been

studied. Future research should consider that religiosity may be more likely to influence

pornography use in men than in women, and that in some samples religiosity and pornography

use may be inversely related.

Table 6

Correlations Between Variables Included in Structural Equation Models

Variables	1	2	3	4	5	6	7	8
1. Baseline frequency of pornography use	–							
2. Baseline religiosity	.04	–.						
3. Baseline depression	-.01	.03	–					
4. Three-month self-perceived excessive pornography use	-.18	.18*	.21*	–				
5. Three-month self-perceived compulsive pornography use	.30*	.08	-.14	-.54*	–			
6. Six-month frequency of pornography use	.53*	.10	-.08	-.26*	.36*	–		
7. Six-month depression	-.21*	.14	.60*	.40*	-.32*	-.20*	–	
8. Baseline religiosity X pornography use	.43*	.89*	.04	.04	.21*	.17	.04	–

Note: $* p < .05$

According to our model, there was no relationship between baseline self-reported time

spent using pornography and feeling that one views pornography excessively or compulsively at

three months. This suggests that perceptions of excessive pornography use and of compulsive

pornography use are not necessarily related to the amount of time an individual spends viewing

pornography. Individuals may view themselves as using pornography excessively or

compulsively while spending little time viewing pornography, while individuals who spend

relatively much time viewing pornography might not view that they view pornography

excessively or compulsively (Gola et al., 2016). This supports previous findings that frequency of pornography use and self-perceived problematic pornography use are distinct constructs (Grubbs, Wilt et al., 2018; Vaillancourt-Morel et al., 2017).

Frequency of Pornography Use Over Time

Frequency of pornography use at baseline predicted frequency of pornography use at six months for women, but not for men. It is possible that the stability of pornography use would not be significantly different between men and women over a longer period of time, but within our six-month time-lag, past pornography use was the best indicator of future pornography use for women. Interestingly, males' less-stable pornography use may suggest somewhat more of an episodic or situationally-dependent relationship with pornography use. Given the stability of females' pornography use, it may be more appropriate to label the use as "trait-like" for females - an integral part of personality and make-up. Whereas, for males, pornography use tends to wax and wane and is not indicative of an overall trait.

Limitations

One limitation of our study is the measure of self-perceived compulsive pornography use, which we created. Because this measure was created using factor analysis of this dataset, this measure and its factor structure may not generalize to other samples. Further study is needed to add support to the psychometric strength of this measure. In addition, the theoretical reason for the difference between the Excessive Use Factor and Compulsive Use is unclear, as the item in Compulsive Use with the highest loading, "I view pornography too often," is similar in terms of face validity to items on the Excessive Use Subscale (e.g., "I spend too much time planning to and using pornography"). However, the other two items that loaded on compulsive use, "I feel

like pornography is addictive," and "I can stop viewing porn whenever I would like," seem to be uniquely related to the idea of viewing pornography use as compulsive.

In addition, the sample of our study may limit the generalizability of our findings. Because the sample was not obtained through random sampling, it may not be fully representative of the general population. For instance, most individuals in our obtained sample were White heterosexuals; the sample represented few homosexuals, bisexuals, and racial minority groups such as African American, Asian, and Latino. These demographic characteristics of our sample may have influenced our findings, as patterns of pornography use differ based on race and sexual orientation (Perry & Schleifer, 2018; Træen & Daneback, 2013). About 14% of our sample identified as a sexual orientation other than heterosexual, which is higher than the national average of about 4 to 9% (Chandra, Copen, & Mosher, 2013). Though pornography use among sexual minorities has been studied (Træen & Daneback, 2013), we know of no research on self-perceived problematic pornography use, religiosity, and depression in this population. In addition, our data had a high rate of attrition, with only 51% of the initial 320-person sample responding to the six-month survey.

Our data, though longitudinal, only covered a six-month time period. It is possible that the effects found here would be different over a longer period of time. In order to more fully examine the longitudinal relationship between pornography use, religiosity, self-perceived problematic pornography use, and depressive symptoms, future studies should use data from a longer period of time, as well as using more data points to get more nuanced findings about change over time. Our sample also had mean depressive symptoms scores (at baseline $M = .64$, $SD = .26$ for males; $M = .69$, $SD = .26$ for females) below cut-offs for depression (Andersen et al., 1994; Björgvinsson et al., 2012), and results might differ in samples that are more depressed.

Though our study has limitations, it also has important implications for the study of self-perceived problematic pornography use. Our study suggests that, contrary to our hypothesis, religiosity does not predict self-perceived problematic pornography use. In support of our hypothesis, our study suggests that self-perceived problematic pornography use predicts depression. Our study also has important implications for sex differences in pornography use, with religiosity predicting pornography use for males, but not for females, and with self-perceived problematic pornography use predicting decreased frequency of pornography use for women, but not for men.

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