



Difficulties in Emotion Regulation and Problematic Pornography Use: The Mediating Role of Loneliness

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ABSTRACT

Objectives: To analyze the association between difficulties in emotion regulation and problematic pornography use (PPU) and test the mediating effect of loneliness. **Methods:** All 339 participants ($M = 28.53$ years, $SD = 10.32$) completed online self-report scales assessing difficulties in emotion regulation, PPU, and loneliness. **Results:** Difficulties in emotion regulation are positively correlated with PPU. Loneliness partially mediates the relationship between difficulties in emotion regulation and PPU. Gender and intimate relationship status had moderating effects on the tested mediation model. **Conclusions:** Greater difficulties in emotion regulation have a significant indirect effect on PPU through loneliness.

ARTICLE HISTORY

Received 2 March 2023
Revised 3 June 2023
Accepted 8 June 2023

KEYWORDS

Difficulties in emotion regulation; problematic pornography use; loneliness; compulsive sexual behavior

Introduction

Emotion regulation is the process of monitoring, assessing, and modifying emotional reactions according to personal objectives and situational requirements (Berking & Wupperman, 2012). This multifactorial perspective of emotion regulation requires the ability to identify, understand, and accept emotional experiences; control impulsive behaviors when distressed; and flexibly modulate emotional responses to cope with the demands of the circumstances (Gratz & Roemer, 2004). Although these abilities improve with age (Orgeta, 2009), difficulties in emotion regulation can occur throughout the life cycle (Kaufman et al., 2016). Emotion regulation difficulties have been associated with unhealthy coping strategies and recognized as a transdiagnostic factor for the development of psychopathology (Aldao et al., 2016; Victor & Klonsky, 2016; Visted et al., 2018).

Sexual behaviors have long been recognized as a possible strategy for coping with circumstances that demand emotion regulation (Bancroft & Vukadinovic, 2004; Walton et al., 2017). Previous studies have supported that individuals with greater

difficulties in emotion regulation show higher impulsivity (Schreiber et al., 2012) and are more likely to engage in addictive behaviors (Estévez et al., 2017; Rogier & Velotti, 2018), including compulsive sexual behaviors (Cashwell et al., 2017; Lew-Starowicz et al., 2020; Pachankis et al., 2015).

Emotion regulation difficulties may contribute to problematic pornography use

Pornography refers to sexually explicit materials, usually, but not always, intended to provide sexual arousal. Nowadays the use of pornography is considered a normative sexual activity, including between romantic partners (Vaillancourt-Morel et al., 2020). For most people, pornography use is not problematic and does not result in negative effects in their life (Kohut et al., 2017). However, for others, it may become problematic and may be associated with adverse consequences.

Some people perceive their pornography use impacts their psychological well-being and their social and vocational functioning (Grubbs et al., 2020; Sniewski et al., 2018). Showing many

similarities with the diagnostic criteria for Hypersexual Disorder, which was proposed but not accepted for inclusion in the DSM-5, the latest version of the International Classification of Diseases (ICD-11) included the diagnosis of Compulsive Sexual Behavior Disorder as an Impulsive Control Disorder (Reed et al., 2022; World Health Organization (WHO), 2018). Problematic pornography use (PPU) may be considered as one form of Compulsive Sexual Behavior Disorder (Kraus & Sweeney, 2019; Mestre-Bach et al., 2021). PPU is generally characterized by a propensity for excessive/compulsive use of pornography and inability to control pornography use, even when trying to reduce it (Bóthe et al., 2018; Grubbs et al., 2018; Sniewski et al., 2018). It is relevant to distinguish between quantity/frequency of pornography use and severity/problematic pornography use. Although these two constructs are positively associated, frequency of pornography use is not a sufficient and/or reliable indicator of PPU (Bóthe et al., 2020). Generally, no major adverse consequences related to the frequency of pornography use are observed; in contrast, in PPU there is a higher likelihood of experiencing negative and harmful consequences (Bóthe et al., 2021).

Research supported on a large sample of the general population identified three pornography-use profiles: non-problematic low-frequency pornography users (68–73% of individuals), non-problematic high-frequency pornography users (19–29%), and problematic high-frequency users (3–8%) (Bóthe et al., 2020). When the authors compared these profiles across more than 40 sociodemographic and psychological characteristics, they found that the problematic high-frequency users reported higher levels of hypersexuality, depressive symptoms, boredom susceptibility, lower levels of self-esteem and frustration regarding basic psychological needs. From a relational perspective research has shown that dyadic use of pornography is associated with higher intimate relationship quality (Kohut et al., 2021), including increased sexual intimacy and sexual satisfaction (Huntington et al., 2021). Solitary use has been linked to reduced relationship commitment (Lambert et al., 2012), lower levels of intimacy and sexual satisfaction

(Morgan, 2011), increased extra-dyadic sexual behavior (Gwinn et al., 2013), and greater likelihood of relationship dissolution (Perry & Schleifer, 2018). Although there is a preponderance of research highlighting that individual pornography use is associated with negative sexual and romantic outcomes, some studies have found links between watching pornography and better sexual communication (Daneback et al., 2009), higher sexual experimentation, and enhanced sexual comfort (Kohut et al., 2017).

Although pleasure-focused motives represent the primary drivers of pornography use, emotional distraction/suppression of negative emotions are also predictors of greater pornography use (Grubbs et al., 2019). When comparing the motivational patterns underlying pornography use and PPU it was found that emotional-avoidance and fantasy motivations were predictors of PPU, but not of frequency of pornography use (Bóthe et al., 2021). PPU can be a potentially maladaptive emotion-regulation strategy to reduce aversive feelings, thoughts, sensations, or urges (Ross et al., 2012; Wéry et al., 2019). The emotion regulation of unpleasant states can influence the decision to use pornography, and its compensatory effects may reduce negative emotions, reinforcing the cognitions associated with the rewarding use of pornography and increasing this behavior as a coping strategy (Brand et al., 2016). Consequently, the pornography use can become problematic if used as a dysfunctional coping strategy for emotion regulation (Mussetti et al., 2022). Furthermore, it has been reported that people with greater difficulties in emotion regulation showed a higher PPU (Cardoso et al., 2022), and it was found that when pornography is used as an avoidance strategy, it is more likely to become problematic (Borgogna & Mcdermott, 2018; Levin et al., 2012).

Loneliness may contribute to problematic pornography use

Even though the link between emotion regulation and loneliness remains understudied, it has been recently demonstrated that the different emotion regulation strategies are related to substantial

variance in perceived loneliness (Preece et al., 2021). Loneliness is a complex construct, generically defined as a negative emotional state related to a distressing or unsatisfactory perception of lack of closeness in interpersonal relationships (Hawley & Cacioppo, 2010). The discrepancy between desired and achieved levels of social relationships can be associated with the number of relationships, frequency of contact, degree of intimacy, or quality of interactions (Dahlberg et al., 2022). However, the high subjectivity of this emotion can explain why some people live solitary lives but do not feel lonely, and others have relatively rich social lives and experience this unpleasant emotion (Hawley & Cacioppo, 2010).

Loneliness can affect people of all ages across all life stages, and its effects have been linked with multiple adverse mental and physical health consequences (Cacioppo & Cacioppo, 2014; Yanguas et al., 2018). The study of the gender effect on perceived loneliness has shown inconsistent results. It has been suggested that women are more likely to experience loneliness than men (Beutel et al., 2017; Victor & Yang, 2012), but later research has shown that men experience more loneliness in young and middle adulthood and women experience it in old age (Barreto et al., 2021; von Soest et al., 2020), while a meta-analysis covering a large sample of individuals reported similar average levels of loneliness across the lifespan for both genders (Maes et al., 2019).

Additionally, it has been shown that being in an intimate relationship is related to lower levels of perceived loneliness, compared to not being in a relationship (Dykstra & Fokkema, 2007; Luhmann & Hawley, 2016). However, it has also been well documented that individuals can feel lonely in partner relationships experienced as unsatisfactory (Givertz et al., 2013; Hsieh & Hawley, 2018; Mund & Johnson, 2021).

People with higher levels of loneliness reported greater use of expressive suppression and were more likely to try to regulate their emotions by actively avoiding social contact (Preece et al., 2021). In addition, loneliness has been associated with higher pornography consumption (Butler et al., 2018), especially among individuals with high levels of attachment anxiety and fear of rejection (Efrati & Amichai-Hamburger, 2019).

Furthermore, a hypothetical bidirectional relationship between pornography use and loneliness was suggested (Butler et al., 2018). With regard to PPU, loneliness was found to be a predictor of this form of use (Camilleri et al., 2021; Cardoso et al., 2022; Okabe & Ito, 2022), and it was further reported that problematic users had the highest levels of loneliness compared to non-problematic users and those at risk of problematic use (Bóthe et al., 2018).

Aims of this study

Considering the aforementioned research, we hypothesize that PPU is an outcome of a maladaptive emotion regulation strategy, which presents itself decomposed as a direct effect, and an indirect effect due to loneliness. Loneliness is a state that may require emotion regulation, and it is known that a higher perception of loneliness is simultaneously related to more dysfunctional emotion regulation strategies and higher self-perceived problems with pornography use. All these findings highlight the importance of loneliness, both in emotion regulation processes and in its association with PPU, providing support for the analysis of its mediating effect on the link between emotion regulation difficulties and PPU.

First, this study aimed to assess the relationship between difficulties in emotion regulation and PPU. Secondly, we aimed to test the mediating role of loneliness in this relationship. Finally, we aimed to examine if gender and intimate relationship status have moderating effects on the tested mediation model.

Methods

Participants and procedure

The present study was part of a larger research examining emotional factors in PPU. Participants were recruited without incentives, using advertisements on social media linked to the online survey. This research targeted adults aged ≥ 18 years that have used pornography at least once in the past 6 months before the study. Data collection began in January 2021 and ended in April 2021.

The initial sample included 639 Portuguese-speaking participants, living in mainland Portugal and its islands. After excluding the 300 participants

(46.8%) who had not used pornography in the past 6 months prior to the study, the final sample was composed of 339 participants with a mean age of 28.53 years old ($SD = 10.32$), mostly men ($n = 187$, 55.2%), that had completed high-school ($n = 162$, 47.8%) or higher education ($n = 175$, 51.6%). Most of the participants were in an intimate relationship ($n = 212$, 62.5%). Additional socio-demographic data is displayed on Table 1.

This cross-sectional study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Ethical Review Board. All participants signed an informed consent.

Measures

Prior to the standardized scales, participants completed a brief questionnaire regarding socio-demographic data and frequency of pornography use.

Difficulties in emotion regulation

The Difficulties in Emotion Regulation Scale Short Form (DERS-SF) (Kaufman et al., 2016) is

Table 1. Socio-demographic and pornography use characteristics ($N = 339$).

Baseline characteristic	<i>n</i>	%
Age (<i>M</i> , <i>SD</i>)	28.53	10.32
Gender		
Female	152	44.8
Male	187	55.2
Educational Level		
Primary school degrees or less	2	0.6
High-school degrees	162	47.8
Higher-education degrees	175	51.6
Intimate Relationship Status		
In an intimate relationship	212	62.5
Not in an intimate relationship	127	37.5
Sexual Orientation		
Heterosexual	304	89.7
Gay/Lesbian	16	4.7
Bisexual	18	5.3
Other	1	0.3
Professional Status		
Student	149	44.0
Employed	170	50.1
Unemployed	19	5.6
Retired	1	0.3
Pornography Use Frequency		
Rarely	77	22.7
Once a month or less	47	13.9
2–3 times a month	81	23.9
1–3 times a week	87	25.7
Every day or almost every day	41	12.1
Several times during the day	6	1.8
Problematic Pornography Use ^a		
Present	16	4.7
Absent	323	95.3

Note. *M*: Mean; *SD*: Standard Deviation; ^aProblematic Pornography Use estimated according to the Problematic Pornography Consumption Scale' cutoff point.

an 18-item self-report measure used to assess difficulties in emotion regulation through 6 factors: restricted access to effective emotion regulation strategies (e.g., “When I’m upset, I believe that I will end up feeling very depressed”); non-acceptance of negative emotions (e.g., “When I’m upset, I feel guilty for feeling that way”); difficulties in controlling impulsive behaviors when experiencing negative emotions (e.g., “When I’m upset, I become out of control”); difficulties to engage in goal-oriented behaviors when experiencing negative emotions (e.g., “When I’m upset, I have difficulty getting work done”); lack of emotional awareness (e.g., “I pay attention to how I feel”); and lack of emotional clarity (e.g., “I am confused about how I feel”). The items are rated on a 5-point Likert scale ranging from (1) “almost never” to (5) “almost always,” with higher scores indicating greater difficulties in emotion regulation. The original study of the DERS-SF reported excellent psychometric properties, with Cronbach’s alpha ranging between 0.79 and 0.91 in the different subscales, and 0.94 for the total scale (Kaufman et al., 2016). In the present study, Cronbach’s alpha coefficient was 0.90 (95% CI [0.89, 0.92]) for the total score; 0.88 (95% CI [0.85, 0.90]) for Strategies; 0.81 (95% CI [0.77, 0.84]) for Non-Acceptance; 0.90 (95% CI [0.88, 0.92]) for Impulse; 0.91 (95% CI [0.89, 0.92]) for Goals; 0.69 (95% CI [0.63, 0.74]) for Awareness; and 0.81 (95% CI [0.77, 0.84]) for Clarity.

Problematic Pornography Use (PPU)

PPU was measured using the Problematic Pornography Consumption Scale (PPCS) (Bóthe et al., 2018). The PPCS is a multidimensional self-report measure, developed to assess the consumption of pornography, allowing to distinguish between problematic and non-problematic use. This brief scale includes 18-items and 6 dimensions: salience (e.g., “I felt porn is an important part of my life”); mood modification (e.g., “Watching porn got rid of my negative feelings”); conflict (e.g., “I felt porn caused problems in my sexual life”); tolerance (e.g., “I felt that I needed more and more porn in order to satisfy my needs”); relapse (e.g., “I resisted watching porn for only a little while before I relapsed”); and withdrawal (e.g., “I became stressed when something

prevented me from watching porn”). Participants rated items concerning past-6-month use of pornography, using a 7-point Likert scale, ranging from (1) “never” to (7) “all the time”. The sensitivity and specificity analyses performed by the authors of the scale with a non-clinical sample, suggested a cutoff of 76 points to indicate a potential PPU, in scores that range from 18 to 126 (Böthe et al., 2018). The internal consistency of the original version of the PPCS is excellent ($\alpha = 0.93$). In the present study, Cronbach’s alpha coefficient was 0.95 (95% CI [0.95, 0.96]) for the total score; 0.77 (95% CI [0.73, 0.81]) for Saliency; 0.82 (95% CI [0.78, 0.85]) for Mood Modification; 0.78 (95% CI [0.73, 0.81]) for Conflict; 0.85 (95% CI [0.83, 0.88]) for Tolerance; 0.89 (95% CI [0.87, 0.91]) for Relapse; and 0.90 (95% CI [0.88, 0.92]) for Withdrawal.

Loneliness

Perceived loneliness was measured using the University of California Los Angeles Loneliness Scale—V3 (UCLALS-3) (Russell, 1996). The UCLALS-3 is a self-report instrument, used to assess feelings of loneliness, social isolation, and lack of connectedness through 20 items suggesting experiences related to both emotional and social dimensions of loneliness (e.g., “How often do you feel that you are no longer close to anyone?”). Items are rated using a 4-point Likert scale ranging from (1) “never” to (4) “always,” with higher total score indicating a greater perceived loneliness. The original study of the psychometric properties of the scale reported a Cronbach’s alpha ranging between 0.89 and 0.94 across multiple samples, and the present study showed similar levels of reliability ($\alpha = 0.94$; [95% CI (0.93, 0.95)]).

Statistical analysis

Descriptive statistics were computed using the mean and standard deviation for continuous data and relative frequencies for nominal data. Correlation between continuous variables was assessed using the Spearman correlation coefficient.

Mediation of the relationship between difficulties in emotion regulation (independent variable, X) and PPU (dependent variable, Y) by loneliness

(mediator, M) was investigated statistically through the analysis of the information provided by generalized linear models represented by the set of Equations 1 to 3.

$$Y = i_1 + cX + e_1, \quad (1)$$

$$Y = i_2 + c'X + bM + e_2, \quad (2)$$

$$M = i_3 + aX + e_3, \quad (3)$$

In the equations above, the coefficients are interpreted as follows: c represents the total effect of difficulties in emotion regulation on PPU, c' is the direct effect of difficulties in emotion regulation on PPU after adjustment for mediator loneliness, b is the direct effect of M after adjustment for difficulties in emotion regulation, a relates difficulties in emotion regulation to the mediator loneliness, while i_1 , i_2 and i_3 are the intercepts and e_1 , e_2 , and e_3 are the residuals. The statistical analysis of the mediation or indirect effect was concluded with a test of significance for the mediated effect represented by the coefficient product ab .

The assumptions were verified, and all were met there for the present analyses.

The data were analyzed using SPSS and AMOS (v. 27, Armonk, NY: IBM Corp). An alpha level of 0.05 was used to established statistical significance.

Results

Considering that pornography use in the past 6 months was a study inclusion criteria, we identified a sample generically indicative of a recreational profile, as only 16 participants showed a score consistent with PPU according to the cutoff score of the assessment measure (Böthe et al., 2018, 2020). Concerning the pornography use frequency, 87 participants (25.7%) reported 1–3 times a week, 81 (23.9%) 2–3 times a month, and 41 (12.1%) every day or almost every day (Table 1).

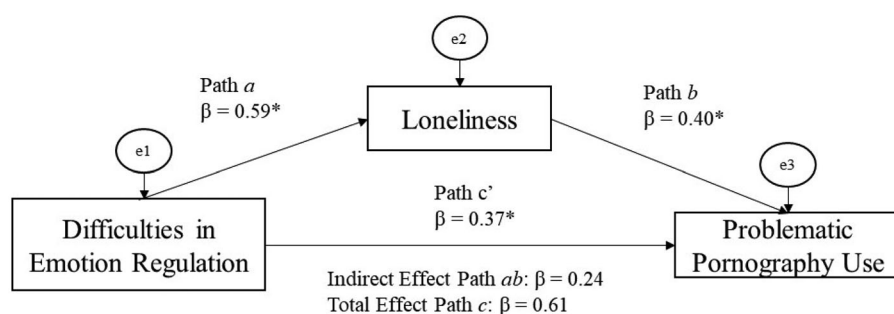
A Spearman correlation between difficulties in emotion regulation and PPU was significant and positive ($r_s = 0.33$, $p < .001$). Loneliness was significantly and positively correlated with difficulties in emotion regulation ($r_s = 0.61$, $p < .001$) and PPU ($r_s = 0.30$, $p < .001$) (Table 2).

Figure 1 and Table 3 presents the direct and indirect or mediated effects of difficulties in emotion regulation on PPU and shows that these

Table 2. Bivariate Spearman correlations.

Variable	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Difficulties in Emotion Regulation	0.86***	0.76***	0.77***	0.79***	0.34***	0.71***	0.33***	0.23***	0.28***	0.33***	0.29***	0.27***	0.35***	0.61***
2. Strategies	—	0.70***	0.64***	0.69***	0.13*	0.59***	0.31***	0.19***	0.26***	0.32***	0.26***	0.29***	0.33***	0.58***
3. Non-acceptance	—	—	0.54***	0.57***	0.05	0.52***	0.29***	0.26***	0.23***	0.28***	0.23***	0.27***	0.29***	0.42***
4. Impulse	—	—	—	0.63***	0.11*	0.43***	0.29***	0.26***	0.27***	0.26***	0.25***	0.21***	0.33***	0.42***
5. Goals	—	—	—	—	-0.04	0.48***	0.28***	0.20***	0.23***	0.28***	0.27***	0.20***	0.33***	0.38***
6. Awareness	—	—	—	—	—	0.23***	0.03	0.01	0.00	0.11	0.06	0.05	0.05	0.32***
7. Clarity	—	—	—	—	—	—	0.26***	0.17***	0.26***	0.26***	0.21***	0.21***	0.23***	0.52***
8. Problematic Pornography Use	—	—	—	—	—	—	—	0.79***	0.87***	0.66***	0.76***	0.65***	0.76***	0.30***
9. Salience	—	—	—	—	—	—	—	—	0.67***	0.43***	0.55***	0.37***	0.61***	0.19***
10. Mood modification	—	—	—	—	—	—	—	—	—	0.49***	0.56***	0.44***	0.64***	0.27***
11. Conflict	—	—	—	—	—	—	—	—	—	—	0.60***	0.59***	0.60***	0.24***
12. Tolerance	—	—	—	—	—	—	—	—	—	—	—	0.52***	0.64***	0.27***
13. Relapse	—	—	—	—	—	—	—	—	—	—	—	—	0.57***	0.29***
14. Withdrawal	—	—	—	—	—	—	—	—	—	—	—	—	—	0.27***
15. Loneliness	—	—	—	—	—	—	—	—	—	—	—	—	—	—

* $p < .05$; ** $p < .01$; *** $p < .001$.

**Figure 1.** Mediation model with standardized values; * $p < .001$.**Table 3.** Direct and mediated effects on problematic pornography use.

Effect	Estimate ^a	SE	Z	95%CI		p
				LL	UL	
Direct effects						
DER → PPU	$c' = 0.369$	0.085	4.337	0.202	0.536	<.001
Loneliness → PPU	$b = 0.403$	0.094	4.280	0.219	0.588	<.001
DER → Loneliness	$a = 0.585$	0.037	15.639	0.512	0.659	<.001
Indirect (mediation) effects						
DER → Loneliness → PPU	$ab = 0.236$	0.057	4.128	0.124	0.348	<.001
Total effects						
DER → PPU	$c = 0.605$	0.067	9.084	0.475	0.736	<.001

Note. SE: Standard Error; CI: Confidence Interval; LL: lower limit; UL: upper limit; ^aStandardized; DER: Difficulties in Emotion Regulation; PPU: Problematic Pornography Use; Estimate. All figures are presented after rounding to 3 decimal places of the computed values; Pathways: Path *a* represented the direct effect of difficulties in emotion regulation on loneliness; Path *b* represented the direct effect of the loneliness on problematic pornography use; Path *c'* represented the direct effect of difficulties in emotion regulation on problematic pornography use; Path *c* represented the total effect of difficulties in emotion regulation on problematic pornography use; Path *ab* represent the indirect effect of difficulties in emotion regulation and loneliness on problematic pornography use.

effects are all statistically significant ($p < .001$). In view of the aims of this work, the results show that the mediation effect of loneliness on the relationship between difficulties in emotion regulation and PPU is significant, and since coefficient c' remains significant, then the mediation by loneliness is partial. The proportion of variance in the dependent variable explained in each of the paths in Figure 1 is given by the following

r-square values: 0.42 (a), 0.20 (b), 0.20 (c), and 0.24 (c').

Mediated effects may depend on other variables, therefore the observed mediated effect of loneliness on the relationship between difficulties in emotion regulation and PPU was investigated in order to determine if it is moderated by gender and by the subject being in an intimate relationship or not. For that purpose, the single

mediator model described by Equations 1–3 was estimated for each subgroup defined by these dichotomous variables, and a statistical test to the equivalence of the product ab point estimates in each subgroup was performed.

Statistical test to moderation effects, using the single mediator model in subgroups of gender and intimate relationship status, was performed (Figure 2). Table 4 shows that the point estimates of the product ab are significantly different between genders ($p = .004$), and therefore, gender significantly moderates the mediation effect of loneliness. Since the value of ab is higher in men, the magnitude of the mediation effect is larger for men than for women. The status of the intimate relationship also moderates the mediation effect of loneliness, as significant differences between subgroups were detected for the ab estimates ($p < .001$). However, in this case, significant mediation only exists in the subgroup of subjects who reported being in an intimate relationship.

Discussion

Our results showed that emotion regulation difficulties are associated with higher PPU, in line

with prior research that has identified links between emotion dysregulation and hypersexuality (Reid et al., 2014) and compulsive sexual behavior (Lew-Starowicz et al., 2020), as well as the relevance of emotion regulation difficulties as predictors of PPU (Cardoso et al., 2022). Earlier studies have reported that pornography use provides a perception of well-being, improving mood, particularly in stressful and boring situations (Paul & Shim, 2008). While the development of this strategy as a way to escape from negative emotions increases PPU (Borgogna & Mcdermott, 2018), it seems that the greater the difficulties in regulating emotions, the more individuals persevere in this pattern, and pornography consumption can escalate to a more problematic level.

Corroborating that the level of loneliness is related to the effectiveness of emotion regulation strategies (Preece et al., 2021), our results revealed that higher perceived loneliness is associated with greater emotion regulation difficulties. Our findings also showed that participants with greater perceptions of loneliness have higher self-perceived problems with pornography use.

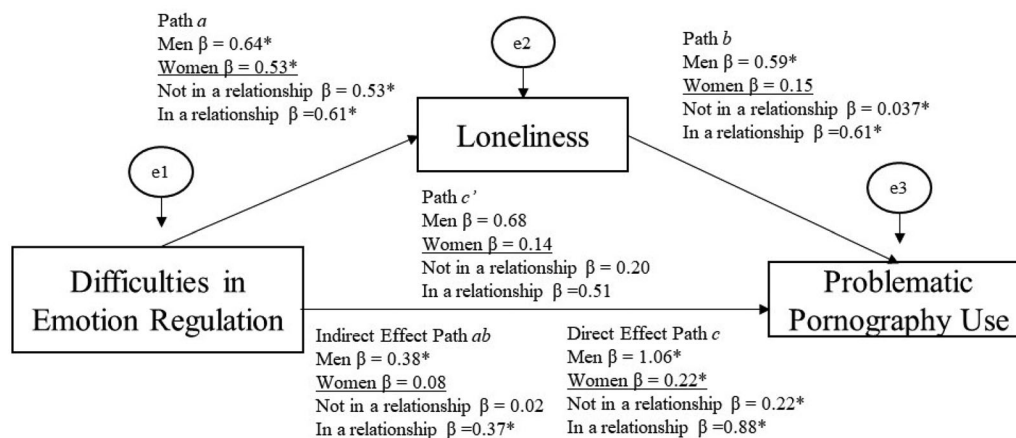


Figure 2. Mediation-Moderation model with standardized values; $*p < .001$.

Table 4. Moderation model for gender and intimate relationship status.

	c'	b	a	c	ab	S_{ab}^a	Z	p
Gender								
Male	0.681	0.592	0.642	1.061	0.380	0.097	2.878	.004
Female	0.138	0.153	0.525	0.218	0.081	0.038		
Intimate relationship (IR) status								
Not in an IR	0.201	0.037	0.528	0.221	0.020	0.052	-3.567	< .001
In an IR	0.506	0.610	0.610	0.878	0.372	0.084		

Note. ^aStandard error of ab .

A compensatory effect of pornography use to counter the lack of social relationships has already been suggested (Butler et al., 2018; Efrati & Amichai-Hamburger, 2019). Concerning PPU, it was reported that problematic pornography users are lonelier than recreational users (Bóthe et al., 2018). People who experience that they cannot have meaningful social relationships may find that pornography is an easy way to feel connected to someone, and this process can escalate into a vicious cycle of PPU, characterized by increased pornography use and even fewer social interactions (Bóthe et al., 2018, 2020).

Regarding the mediating role of loneliness, our results demonstrated that loneliness has a partial mediating effect on the relationship between difficulties in emotion regulation and PPU. Therefore, loneliness improves our understanding of such relationship, as it has an intervening effect by which the effects of difficulties in emotion regulation are transmitted to PPU. As loneliness is a state that may require emotion regulation, a higher perception of loneliness seems to be simultaneously related to greater difficulties in emotion regulation (Preece et al., 2021) and higher self-perceived problems with pornography use (Bóthe et al., 2018; Camilleri et al., 2021). Although pornography use may be an effective strategy to cope with or avoid adverse emotional states such as loneliness, paradoxically, it may lead to a rise of unpleasant emotions over time (Levin et al., 2019). Previous research showed that emotional avoidance motivations were predictors of PPU (Bóthe et al., 2021), and PPU can emerge as a potential maladaptive emotion-regulation strategy (Ross et al., 2012; Sniewski et al., 2018; Wéry et al., 2019). Additionally, people with higher levels of loneliness are more likely to experience other negative emotions (Heinrich & Gullone, 2006), with correspondingly greater emotion regulation efforts. It has long been known that loneliness is a major cause of boredom (Harris, 2000). Since boredom is an aversive state of low arousal and dissatisfaction, associated with a perception of the environment as unstimulating or monotonous (Mikulas & Vodanovich, 1993), people try to mitigate this unpleasant state by seeking alternative experiences, including behaviors indicative of decreased

self-control (Kılıç et al., 2020). We hypothesize that given the experiential proximity between loneliness and boredom, both may reinforce the use of pornography and the vicious cycle of PPU, in order to feel arousal and pleasure, as well as to help in the regulation of negative emotional states.

In addition, our results showed that gender and intimate relationship status have a moderating effect on the mediating role of loneliness in the relationship between emotion regulation difficulties and PPU. Although the empirical findings on gender differences in loneliness reflect inconsistent results, it has been suggested that during young adulthood men are more vulnerable to loneliness than women (Barreto et al., 2021; Maes et al., 2019), which may contribute to explain the gender effect we found, since our sample has an average age in line with this life stage. Additionally, gender identity as a man is the greatest predictor of pornography use (Grubbs et al., 2019), and men report higher self-perceived problems with pornography use than women (Grubbs et al., 2020).

With regard to intimate relationship status, our results showed that the mediating role of loneliness in the association between emotional difficulties and PPU was only significantly expressed in the group of participants who reported being in a relationship. Intuitively it may seem contradictory to be in an intimate relationship and simultaneously feel loneliness. However, loneliness is perceived as an aversive emotion, clearly distinguishable from the objective state of solitude or being alone (Heinrich & Gullone, 2006). Being in a relationship is not an “antidote” to experiencing loneliness, particularly in intimate relationships perceived as unsatisfactory (Givertz et al., 2013; Hsieh & Hawkey, 2018; Mund & Johnson, 2021). Loneliness in relationships can be especially distressing because it is inconsistent with expectations about what being in an intimate relationship represents and can have a substantial effect on emotional well-being (Rokach et al., 2022).

Research has shown that people in a relationship, particularly those who report lower intimate relationship satisfaction, negative communication patterns, and insecure attachment, seek online

sexual activities, including pornography use (Ballester-Arnal et al., 2014; Li & Zheng, 2017). Thus, it is plausible that people in unsatisfying relationships use pornography as an avoidance strategy and a mood elevator to cope with negative emotions. In addition, the acceptability of pornography has been increasing over time, but pornography use remains framed by moral implications (Grubbs et al., 2019). It is possible that among participants with higher levels of loneliness who reported being in an intimate relationship, the use of pornography to cope with adverse emotions may be contributing to moral constraints and consequently to greater self-perceived problems with pornography use. Furthermore, it was found that among men, relationship adjustment and pornography use are negatively and reciprocally related (Muusses et al., 2015). Based on this finding we hypothesize that lower relational quality may require higher emotion regulation skills and consequently, emotion regulation difficulties may increase PPU, with possible negative effects on the relationship. Interestingly, the reported reciprocal relationship was found only in male partners (Muusses et al., 2015), which may be partially explained by our result regarding the greater magnitude of the mediating effect of loneliness in this group compared to the women's group.

Our study makes a useful contribution to a better understanding of the relationship between emotion regulation difficulties and PPU, with a particular emphasis on the mediating role of loneliness. However, the findings of the present study should be interpreted taking into consideration several limitations.

First, we used a convenience sample, mostly of young adults, which limits the generalizability of the present findings. All the variables in our study may reflect an age effect, namely the adaptiveness of emotion regulation strategies (Kaufman et al., 2016), the motivations to use pornography (Bóthe et al., 2021) and the circumstances associated with the life cycle and their impact on loneliness (Cacioppo et al., 2015). Secondly, this approach to mediation based on linear regression and indirect effects through loneliness has several limitations for purposes of interpretation of causality. Though a mediation hypothesis is a causal hypothesis, the regression

models used to test it are not causal, since the independent and mediator variables considered herein were not manipulated, and therefore, the relationships between them are intrinsically correlational. Moreover, a strong causal interpretation would require the maximum information about the intermediate process through which causality flows, which is not warranted by a single mediator model. Furthermore, using cross-sectional data to test a mediation limits differences concerning the temporal precedence of the variables in the model. Future longitudinal studies are needed to determine directionality, or even a plausible bidirectional effect with a reciprocal impact on emotion regulation difficulties and PPU, in the medium and long term. Thirdly, besides loneliness, no data were collected on mental health variables potentially associated with emotion regulation difficulties. Considering that the latter have been associated with unhealthy coping strategies, as well as their implications for interpersonal relationships and the development of psychopathological symptoms (Aldao et al., 2016; Victor & Klonsky, 2016; Visted et al., 2018), future research could expand on our work to other mental health constructs (e.g., anxiety, depression, boredom, well-being).

Considering that religious affiliation and moral incongruence may be related to PPU (Grubbs & Perry, 2019; Mestre-Bach et al., 2021), the non-assessment of these variables is another important limitation. Individuals with higher levels of religiosity and religious scrupulosity may be more likely to perceive that they have PPU, largely as a result of their moral disapproval of this behavior (Grubbs et al., 2015). For some people, the moral burden associated with pornography use may lead them to feel shame and guilt, concomitant with a problematization of pornography consumption (Grubbs et al., 2018). Thus, future studies should include assessments of religious affiliation and moral incongruence. In addition, the stigma associated with loneliness, particularly in young adults (Barreto et al., 2022) could have strengthened the social desirability mechanisms in the participants' answers. Finally, although the UCLALS-3 is a well-validated and widely used measure, loneliness is a complex and multidimensional construct that is difficult to assess with

a unidimensional scale (Heinrich & Gullone, 2006). The use of qualitative methods to assess loneliness, as well as emotion regulation difficulties, could provide a better understanding of these phenomena.

Overall, these findings highlight the role of loneliness in the relationship between emotion regulation difficulties and PPU. Clinically, these results suggest that the relationship between difficulties in emotion regulation and PPU is not spurious, and that perceived loneliness intervenes to transmit the effects of difficulties in emotion regulation to PPU. Thus, targeting adaptive coping with loneliness may induce intervening effects that may reduce the effects of difficulties in emotion regulation, in individuals with PPU.

Ethical approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of the Egas Moniz School of Health and Science–Portugal (No. 768-CEEM).

Disclosure statement

No potential conflict of interest was reported by the author(s).

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No potential conflict of interest was reported by the author(s).

Funding


This work was supported by the FCT–Foundation for Science and Technology, I.P., under the project UIDB/04585/2020.

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