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FULL-LENGTH REPORT

Symptoms of problematic pornography use among help-seeking male adolescents: Latent profile and network analysis

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ABSTRACT

Background and aims: Little data exist on exploring the subgroups and characteristics of problematic pornography use (PPU) in help-seeking adolescents. The aims of the study were to classify the subgroups among help-seeking male adolescents, explore their similarities and differences, and uncover their core symptoms. *Methods:* A total of 3,468 Chinese male adolescents (M_{age} = 16.64 years, SD = 1.24) who were distressed about their pornography use were recruited. The Problematic Pornography Consumption Scale, the Brief Pornography Screen Scale, and Moral Disapproval of Pornography Use were used to classify them. The General Health Questionnaire, the Pornography Craving Questionnaire, and the Sexual Compulsivity Scale were used to investigate participants' negative consequence related to their pornography use; and the Online Sexual Activity Questionnaire (OSAs) and time spent on pornography use every week were considered as quantitative indicators. *Results:* Help-seeking male adolescents could be divided into 3 profiles, namely, self-perceived problematic (SP, n = 755), impaired control (IC, n = 1,656), and problematic use groups (PPU, n = 1,057). Frequency of OSAs was important for the identification of SP individuals, while negative consequences were more effective in identifying individuals with objective dysregulated behavior. Salience and mood modification were shared by all groups; however, in addition to this, the SP and PPU groups also showed withdrawal symptoms. *Discussion and conclusion:* This study's results provide support for the presence of different profiles of help-seeking individuals and information on potential intervention targets among adolescents which is lacking in the literature.

KEYWORDS

adolescents, problematic pornography use, impaired control, moral incongruence, network analysis

INTRODUCTION

With the spread of the internet, people have easy and anonymous access to pornographic materials (Binnie & Reavey, 2020), and online pornography is rapidly becoming an important and primary source of sexual information for both adolescents and adults (Daneback, Månsson, Ross, & Markham, 2012; Hilton, 2021; Litsou, Byron, McKee, & Ingham, 2021). Many scholars argued that pornography may be a ready source of basic sexuality-related information for adolescents (George et al., 2018; Noll, Shenk, Barnes, & Haralson, 2013; Peter & Valkenburg, 2016). Even in Eastern countries with conservative attitudes toward sex (Chen et al., 2018; Chowdhury, Chowdhury, Kabir, Perera, & Kader, 2018; Hald & Mulya, 2013),

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such as China, where it is difficult for them to obtain sexuality-related information from parents or in school (Chi, Yu, & Winter, 2012; Cui et al., 2021). Cultural characteristics may influence attitudes toward pornography use (Vaillancourt-Morel et al., 2017; Vaillancourt-Morel & Bergeron, 2019); however, current understanding of pornography use has cultural limitations since previous studies mainly took place in Western, industrialized countries with predominately Christian adult samples (Kraus & Sweeney, 2019). Therefore, it is necessary to understand pornography use in China, which may provide a unique perspective of the potential influence of the conservative culture on pornography use.

Adolescence is a pivotal period for the development of individuals' sexual values and sexual consciousness, and curiosity about sexuality increases during this period (Baams, Dubas, Overbeek, & van Aken, 2015). Data from Western countries and China showed that teenagers tended to have their first experience with pornography around the age of 12 (Chen, Jiang, Luo, Kraus, & Bőthe, 2022; Sinković, Štulhofer, & Božić, 2013), and more than 50% reported using it weekly or more often (Bőthe, Vaillancourt-Morel, et al., 2020). Excessive pornography use may result in dysregulated or problematic pornography use (PPU), and previous studies showed that 5–14% of teenagers may experience PPU (Bőthe, Vaillancourt-Morel, Dion, Štulhofer, & Bergeron, 2021; Doornwaard, van den Eijnden, Baams, Vanwesenbeeck, & ter Bogt, 2016; Efrati & Gola, 2018b; Pizzol, Bertoldo, & Foresta, 2016; Štulhofer, Rousseau, & Shekarchi, 2020; Svedin, Akerman, & Priebe, 2011) and may be related to many aspects of their life, such as intimate relationship (Stanley et al., 2018), well-being (Kohut & Štulhofer, 2018), sexual problems (Efrati & Amichai-Hamburger, 2021; Owens, Behun, Manning, & Reid, 2012), or sexual aggression (Wright, Tokunaga, & Kraus, 2016). Thus, it is essential to examine adolescents' pornography use and screen for and classify those who are at the risk of problematic use to be able to provide targeted help or intervention for them as early as possible.

Most studies define PPU as pornography use characterized by diminished self-control and continued, intensive engagement in it despite distress and adverse consequences (Bőthe, Tóth-Király, Potenza, Orosz, & Demetrovics, 2020; Chen et al., 2018; Cooper, Delmonico, Griffin-Shelley, & Mathy, 2004; Efrati & Gola, 2018a; Svedin et al., 2011; Vaillancourt-Morel & Bergeron, 2019; Wordecha et al., 2018), and consider it as a subcategory of compulsive sexual behavior disorder (CSBD) in accordance with the 11th edition of the International Classification of Diseases (Bőthe, Tóth-Király, Demetrovics, & Orosz, 2021; Kraus & Sweeney, 2019; World Health Organization, 2022).

In recent years, studies have found that a significant proportion of the treatment-seeking group looked for help because they believed they were "addicted" to pornography, but their distress about pornography use might be better attributed to moral incongruence towards pornography use (Grubbs, Exline, Pargament, Hook, & Carlisle, 2015; Grubbs, Exline, Pargament, Volk, & Lindberg, 2017; Grubbs, Perry, Wilt, & Reid, 2019). Therefore, it was proposed that problems related to pornography use may arise from two distinct pathways: dysregulated use and problems due to moral incongruence (hereafter PPMI, pornography problems due to moral incongruence) (Grubbs, Perry, et al., 2019). In this model, impaired control and compulsive patterns of pornography use are features of the behavioral pathway. The second pathway describes self-perceived problematic pornography use which appears as a result of pornography use (even with a low frequency) despite one's strong values against pornography use, resulting in a contradiction between values and behaviors. And this discrepancy leads to self-perceived PPU or PPMI. Lastly, it is important to mention that these two pathways may be present simultaneously as well.

Supporting the notions of the aforementioned model (Grubbs, Perry, et al., 2019), a recent study suggested that three sub-groups could be identified among help-seeking adult men (Chen, Jiang, Luo, Kraus, & Bőthe, 2022): self-perceived problematic group (SP group, i.e., the highest levels of moral incongruence for pornography use with no dysregulated behaviors), impaired control group (IC group, i.e., persistent pattern of failure to control intense, repetitive impulses or urges resulting in repetitive pornography use), and PPU group (i.e., persistent pattern of failure to control intense, repetitive impulses or urges resulting in repetitive pornography use and higher levels of salience, tolerance, withdrawal, mood modification, conflict, and relapse as well).

Yet, these potential help-seeking groups mentioned above have not been explored among adolescents. It is well documented that the human brain experiences several major morphological and functional changes during adolescence (Giedd et al., 1999; Giedd, 2004). In particular, the frontal cortex of the brain, which is important for higher-order cognitive functions (e.g., the ability to inhibit impulses, weighing consequences of decisions, prioritizing, and strategizing), does not fully mature until the mid-to-late twenties (Giedd, 2004; Hilton, 2021; Johnson, Blum, & Giedd, 2009) whereas the reward system (e.g., nucleus accumbens) is hypersensitive in early adolescence (Doremus-Fitzwater, Varlinskaya, & Spear, 2010; Ernst, Pine, & Hardin, 2006). Supporting this notion, it has been demonstrated that adolescents are more responsive to rewards and more vulnerable to them than adults (Sturman & Moghaddam, 2012), such as having a greater risk of developing addictions (Doremus-Fitzwater et al., 2010). Therefore, in accordance with the propositions of recent calls (Grubbs & Kraus, 2021), rigorous studies of the full spectrum of the potential effects of pornography during adolescence are of value. However, only a handful of studies have been conducted on adolescents; pornography use (e.g., Bőthe, Vaillancourt-Morel, Bergeron, & Demetrovics, 2019; Bőthe, Vaillancourt-Morel, et al., 2020; Peter & Valkenburg, 2016; Wright, Paul, & Herbenick, 2021), much fewer on adolescents' PPU (e.g., Bőthe, Vaillancourt-Morel, et al., 2021; Rousseau, Bőthe, & Štulhofer, 2021; Štulhofer, Tafro, & Kohut, 2019), and none on treatment-seeking adolescents for pornography use, potentially due to ethical concerns and difficulties in recruitment. Therefore, the first aim of the

present study was to identify subgroups of help-seeking adolescents by simultaneously considering impaired control, PPU, and moral incongruence towards pornography use, following previous protocols (Chen, Jiang, Luo, et al., 2022).

Moreover, there is lack of evidence to demonstrate the similarities and differences between the aforementioned three groups, which are critical for the diagnosis of PPU. PPU is a complex phenomenon, and prominent differences were observed between objective behavioral dysregulation and self-perceived addiction to pornography (Grubbs, Kraus, & Perry, 2019). Using a combination of multiple indicators may be more efficient and accurate when identifying individuals with PPU (Chen & Jiang, 2020). According to previous studies, the frequency and usage time of online pornography can be considered as quantitative indicators of pornography use (Bőthe, Tóth-Király, et al., 2021), but they are not sufficient indicators of PPU in themselves (Chen, Jiang, Wang, et al., 2022). Individuals with PPU might have difficulties restraining themselves from using pornography, despite the negative emotions and adverse consequences (Binnie & Reavey, 2020; Wetterneck, Burgess, Short, Smith, & Cervantes, 2012). Additionally, to further examine the validity of the extracted profiles, it is required to examine whether the identified profiles are related to theoretically meaningful constructs that are not directly used in the classification process (Morin, Morizot, Boudrias, & Madore, 2011). Therefore, building on the findings of previous studies, this study aimed to examine not only the frequency of pornography and PPU symptoms, but also mental health status (Chen & Jiang, 2020), compulsive sexual behaviors (Kraus, Voon, Kor, & Potenza, 2016), and pornography craving (Drummond, Litten, Lowman, & Hunt, 2000; Kraus & Rosenberg, 2014) as additional characteristics to assess the quality and characteristics of pornography use. More specifically, the second aim of this study was to explore the similarities and differences between groups of help-seeking male adolescents on each aforementioned indicator, which will be helpful to improve the accuracy of PPU assessment.

Lastly, prior findings suggest that peripheral and core symptoms may be present in the case of PPU (Bőthe, Lonza, Štulhofer, & Demetrovics, 2020). Individuals with objective dysregulation can experience core symptoms such as tolerance and withdrawal (Chen et al., 2021). However, individuals who experience moral conflicts related pornography use might be more likely to face intense psychological distress for pornography use and demonstrate spiritual struggles including interpersonal conflict (Grubbs et al., 2017). Yet, these potential differences have not been explored among adolescents. Therefore, the third aim of this study was to uncover the core symptoms of PPU in potential subgroups of help-seeking male adolescents, which will benefit rapid classification and diagnosis.

The current study

As men have stronger sexual desire than women, and as increased sexual desire might be related to pornography use (Buss, 1995; Malamuth, 1996; Salmon, 2012), men relative to women typically show stronger cravings for pornography (Hald, 2006; Martyniuk, Briken, Sehner, Richter-Appelt, & Dekker, 2016), and a higher proportion of them are among treatment-seeking individuals for PPU (Bőthe et al., 2018; Grubbs, Kraus, & Perry, 2019). Similarly, male adolescents use more pornography than female adolescents and have higher levels of PPU in general (Bőthe, Vaillancourt-Morel, et al., 2020; Bőthe, Vaillancourt-Morel, et al., 2021). Therefore, the current study focused on male adolescents.

The purpose of this study was to explore whether quantitatively and qualitatively distinct sub-groups exist in the male adolescent help-seeking population. Based on previous work (Chen, Jiang, Luo, et al., 2022; Kraus & Sweeney, 2019), we hypothesized that three distinct profiles of treatment-seeking male adolescents would emerge: self-perceived problematic pornography use group, impaired control group, and problematic pornography use group. We expected that individuals in the self-perceived profile would report lower scores on variables related to pornography use except for moral incongruence than the other groups, those in the impaired control profile would have moderate scores, and those in the problematic profile would have the highest scores. Also, we sought to take an exploratory look at the core symptoms of each profile using network analysis.

METHODS

Procedure and participants

The definition of adolescence differs from one country to another (Kathawate & Ghosh, 2013; Ngwenya & Ramukumba, 2017; Sawyer, Azzopardi, Wickremarathne, & Patton, 2018; World Health Organization, 2017). Given that the Medical Subject Headings (MeSH) vocabulary thesaurus definition describes an adolescent (unique ID: D000293) as a person between the ages of 13 and 18 years old (MeSH, 2022), and this definition was also used in previous studies from China (Guo et al., 2014; Yang, Yan, Xu, Tan, & Zhu, 2021), we recruited male adolescents aged 13–18 years for the present study.

This study only considered male adolescents who sought help for pornography use through a non-profit website (www.ryeboy.org/, for more details, see Supplementary material 1) in China. The website aimed to help young men who felt they had a problem with their pornography use. The site was designed to help registered users establish healthy habits (e.g., regular physical exercising and sleeping) to reduce their pornography use. This non-profit website was developed as a smartphone-based application to be convenient for users. The vast majority of participants discovered the organization via app store searches and voluntarily registered. When new users registered to the application, they were transferred to a page introducing the survey battery (a summary of all variables assessed in the survey can be seen in Supplementary material 2). Participants voluntarily chose to complete the self-report, anonymous survey, which took about 15 to 25 minutes. Data

collection took place on this website via an online survey from August 2020 to December 2020.

Before presenting the pornography-related measures, a clear definition of pornography (Bőthe et al., 2018; Hald & Malamuth, 2008; Reid, Li, Gilliland, Stein, & Fong, 2011) was provided to the participants in order to avoid potential biases resulting from individual variations (Willoughby & Busby, 2016): Pornography was defined as material that (i) creates or elicits sexual feelings or thoughts and (ii) contains explicit exposure or descriptions of sexual acts involving the genitals, such as vaginal or anal intercourse, oral sex, or masturbation.

In total, 4,035 people who responded "yes" to the question of "Do you think you have problems with pornography use and need help?" participated in this study. Before the analyses, the data were screened and participants were removed for the following reasons: (i) they were either overage or underage (347 individuals); (ii) they either failed the attention test or provided contradictory responses (e.g., the actual age was younger than the age of first exposure to pornography) (96 individuals); (iii) they had not participated in online sexual activities (OSAs, e.g., watching pornography, engaging in sex chats, exchanging erotic pictures online, searching for sexual partners) in the past three months (46 individuals); and (iv) were not males (78 individuals). No a priori power analysis was conducted to determine sample size, as no previous studies were conducted in adolescent help-seeking populations that could have informed this analysis. Thus, the study aimed to collect data from as many participants as possible, resulting in a total sample of 3,486 help-seeking male adolescents aged between 13 and 18 years, with an average age of 16.64 (SD = 1.24) years (see Table 1 for demographic characteristics).

Measures

Problematic Pornography Consumption Scale (PPCS). The PPCS was developed by Bőthe et al. (2018), it includes 18 items concerning the past six-month use of pornography based on Griffiths' components model of addiction (Griffiths, 2005; six dimensions: salience, mood modification, conflict, tolerance, relapse, and withdrawal). Each dimension is measured by three items (e.g., "I felt that I had to watch more and more porn for satisfaction"). Answer options range from 1 (*never*) to 7 (*all the time*) on a seven-point Likert scale. Higher scores indicate higher levels of PPU. Bőthe et al. (2018) suggested a cut-off score of ≥76 to identify individuals at risk of PPU. The Cronbach's alpha of this scale was 0.94 in this study.

Brief Pornography Screen (BPS). The BPS (Kraus et al., 2020) measures the lack of self-control and overuse of pornography (e.g., "You have attempted to "cut back" or stop using pornography, but were unsuccessful"). Item responses were 0 (*never*), 1 (*occasionally*), and 2 (*very often*), with a total scoring range from 0 to 10. Higher scores indicate higher levels of impaired control regarding pornography use, and the clinical cut-off is 4 points. The scale's Cronbach's alpha was 0.86 in this study.

Pornography Craving Questionnaire (PCQ). In the PCQ, developed by Kraus and Rosenberg (2014), participants rated their agreement with 12 items from 1 (*completely disagree*) to 7 (*completely agree*). It is a one-dimensional measurement (e.g., "I have an urge to watch porn right now"). The overall score ranges from 12 to 84, higher scores indicate greater cravings for pornography. In this study, the PCQ's Cronbach's alpha was 0.91.

Table 1. Sociodemographic characteristics of each group

Variables[a]	Total (N = 3,468)	SP group (n = 755)	IC group (n = 1,656)	PPU group (n = 1,057)	$F/\chi 2$	p
Age/years	16.64 ± 1.24	16.60 ± 1.31	16.70 ± 1.22	16.63 ± 1.23	0.60	0.941
Sexual orientation					0.69	0.502
Homosexual	147 (4.2%)	33 (4.4%)	65 (3.9%)	49 (4.9%)		
Heterosexual	3,093 (89.2%)	682 (90.3%)	1,481 (89.5%)	930 (88%)		
Bisexual	228 (6.6%)	40 (5.3%)	110 (6.6%)	78 (7.4%)		
Relationship status					0.17	0.845
Single	3,197 (92.2%)	706 (93.5%)	1,525 (92.1%)	973 (92.1%)		
Partnered	271 (7.8%)	49 (6.5%)	131 (7.9%)	84 (7.9%)		
Education					0.89	0.411
Primary School or below	41 (1.2%)	8 (1.1%)	14 (0.8%)	19 (1.8%)		
Vocational School	639 (18.4%)	140 (18.5%)	295 (17.9%)	204 (19.3%)		
Middle and High School	2,459 (70.9%)	485 (64.2%)	1,183 (71.4%)	746 (70.6%)		
University or college	329 (9.5%)	77 (10.2%)	164 (9.9%)	88 (8.3%)		
Place of residence					1.153	0.316
Capital	371 (10.7%)	94 (12.5%)	158 (9.5%)	119 (11.3%)		
County Town	1,503 (43.3%)	323 (42.7%)	752 (45.4%)	428 (40.5%)		
Town	848 (24.5%)	181 (24%)	399 (24.1%)	268 (25.4%)		
Village	746 (21.5%)	157 (20.8%)	347 (21%)	242 (22.8%)		

Note: SP group = Self-perceived Problematic group, IC group = Impaired Control group, PPU group = Problematic Pornography Use group.

Questionnaire of Online Sexual Activities (OSAs). Thirteen items were used to measure participants' use of the internet for the following purposes: (i) viewing sexual-explicit materials (SEM), (ii) seeking sexual partners, (iii) cybersex, and (iv) flirting and sexual relationship maintenance (Zheng & Zheng, 2014). Viewing SEM was assessed via 5 items that were rated from 1 (*never*) to 9 (*at least once a day*) (e.g., "In the past 3 months, how often do you visit erotic websites?"). For the scales assessing the frequency of sexual partner seeking, cybersex, and flirting, participants used a response scaler from 1 (*0 time*) to 9 (*20 or more times*). In this study, only total scores were used, and the different dimensions of OSAs were not analyzed separately. Higher scores indicated more frequent engagement in the OSAs. The OSAs scale's Cronbach alpha was 0.87 in this study.

Sexual Compulsivity Scale (SCS). The SCS (Kalichman & Rompa, 1995) includes 10 items assessing sexual compulsivity (e.g., "I think about sex more than I would like to"). Answer options for each item range from 1 (*not at all like me*) to 4 (*very much like me*) on a four-point Likert scale. Higher scores suggest more difficulties with controlling sexual thoughts and behaviors. The Cronbach's alpha of this scale was 0.91.

Time Spent on Pornography Weekly. Participants were asked about the amount of time spent on pornography use each week in the last month: "On average, how many hours did you spend on pornography every week in the last month?".

12-item General Health Questionnaire (GHQ-12). The GHQ-12 (Goldberg & Hillier, 1979; Goldberg et al., 1997) is a 12-item questionnaire designed for the assessment of psychological distress (six positive and six negative items), each scored on a four-point Likert scale [negative items: range from 0 (*not at all*) to 3 (*much more than usual*), positive items: range from 0 (*more so/better than usual*) to 3 (*much worse/less than usual*), e.g., "Been feeling reasonably happy"], with higher scores reflecting worse psychological health. The Cronbach's alpha of GHQ was 0.92 in this study.

Moral Disapproval of Pornography Use. Four pre-established items (Grubbs et al., 2015) were used to assess moral disapproval of pornography use: "Viewing pornography online troubles my conscience", "Viewing pornography online violates my religious beliefs", "I believe that viewing pornography online is morally wrong", and "I believe viewing pornography online is a sin". Participants rated their agreement with each item on a scale from 1 (*not at all*) to 7 (*extremely*). The higher the score, the greater moral struggle the individual feels about using pornography. The scale's Cronbach's alpha was 0.88 in this study.

Data analysis

Statistical analyses were conducted using SPSS 22.0, Mplus 8.3, and the bootnet, qgraph, and dplyr packages of R-4.0.2.

Latent Profile Analysis. First, we used Latent Profile Analysis (LPA) to identify the sub-groups among help-seeking male adolescents. To determine the number of latent profiles, Akaike information criterion (AIC), Bayesian Information Criterions (BIC), Sample-Size Adjusted Bayesian Information Criterions (aBIC), Lo-Mendell-Rubin Likelihood Ratio Test (LMRT), and Entropy were used. The aforementioned indicators are greatly affected by the sample size, and it is difficult to obtain the best-fitting model when analyzing a large sample with a large number of categories (Bőthe, Tóth-Király, et al., 2020). In this case, information criteria (AIC, BIC, CAIC, and SSABIC) can be graphically presented with "elbow plots" to illustrate the gains related to additional profiles (Morin, Maïano, et al., 2011; Morin & Marsh, 2015; Morin, Meyer, Creusier, & Biétry, 2016; Petras & Masyn, 2010), the point after which the slope in the elbow plot flattens indicates the optimal number of profiles, but the profiles' meaning should also be considered (Morin et al., 2016; Petras & Masyn, 2010). In the current study, to identify possible subgroups of help-seeking male adolescents, LPA was conducted using the dimensions of each scale as profile indicators, including six dimensions of PPCS (salience, mood modification, conflict, tolerance, relapse, and withdrawal), BPS, and moral incongruence.

Network analysis. Network analysis is an ideal method to explore the node (variables) predictability and core symptoms of psychopathological phenomena (Werner, Stulhofer, Waldorp, & Jurin, 2018). In this study, network analysis was applied in four steps. First, a regularized partial correlation network was established. In order to reduce the appearance of false connections the "last absolute shrinkage and selection operator" (LASSO) was adopted, and the parameter λ was adjusted to 0.5 (Epskamp & Fried, 2018; Foygel & Drton, 2010). Next, to further explore differences in the structure of connectivity among PPU and the related quantitative and qualitative indicators across subgroups, we also conducted a community detection algorithm. A community is a cluster of nodes (factors or variables) that have more strongly connected subnetworks in the network, and allows to visually detect which indicators are more closely associated with the PPU. We used the spinglass algorithm derived from principles of statistical mechanics (Reichardt & Bornholdt, 2006) with igraph package (Csardi & Nepusz, 2006). Then, the Mixed Graphical Models (MGM) was used to perform predictability analysis (Haslbeck & Waldorp, 2020). Predictability refers to how a given node can be predicted by all other nodes in the network (Haslbeck & Fried, 2017). The specific values given by the predictability analysis can help to identify the more critical metrics (indicators) when assessing PPU. Lastly, the centrality indices (node strength, closeness and betweenness) were calculated to reflect the importance of each node (symptom). The Case-Dropping Subset Bootstrap was conducted to evaluate the stability of the centrality, and the correlation stability (CS) coefficient was considered as the selection criteria ($\geq$0.25 for acceptable fit, $\geq$0.5 for excellent fit) (Epskamp, Borsboom, & Fried, 2018).

Ethics

The study was approved by the local ethics committee and was conducted in accordance with the 1964 declaration of Helsinki and its later amendments. All subjects were informed about the study and signed an informed consent form before their inclusion in this study. According to the regulations of the Information security technology-Personal information security specification in China (Chinese National Standard: GB/T 35273-2020), individuals under the age of 18 but over the age of 14 can consent and provide their own data or their guardians can do so on their behalf, while individuals under the age of 14 must acquire the approval of their guardians. Given the sensitive nature of the survey, not relying on parental consent ensures anonymity and reduces sample biases that may distort the results. Accordingly, adolescents aged 14 and older gave their own informed consent in this study. Adolescents aged 13 years, participated in the study after their guardians (contacted by email and/or phone) signed an informed consent form (45 individuals).

RESULTS

Potential profiles of help-seeking male adolescents

As expected, the results of the LMRT Test did not suggest an unambiguous solution, presumably as a result of the large sample size (Supplementary material 3, Table S1). Therefore, the elbow plot was examined (Supplementary material 3, Figure S1). According to the results of the elbow plot, the flat part was reached around the 3-4-5-profile solutions. The entropy of the 3-class solution was the highest, and was in line with the classification suggested by Kraus and Sweeney (2019). Therefore, the 3-class solution was chosen as the final model.

As shown in Fig. 1, the first group scored below the cut-off score of BPS and PPCS [BPS: 3.14 vs 4, t (df = 754) = −10.23, P < 0.001; PPCS: 36.53 *vs* 76, t (df = 754) = −103.49, P < 0.001], but had high moral incongruence (rating from 1 to 7, M = 4.34, SD = 1.95), indicating that the presence of objective behavior dysregulation was less likely. Thus, the profile was named self-perceived problematic group (SP). The second group reported higher score than the cut-off of BPS [7.11 *vs* 4, t (df = 1,655) = 58.98, P < 0.001], but lower scores than the cut-off of PPCS [67.36 vs 76, t (df = 1,655) = −33.14, P < 0.001] and higher levels of moral incongruence (M = 4.20, SD = 1.80), highlighting the lack of control over pornography use. This group was named the impaired control group (IC). The third group was characterized by higher than cut-off score of both BPS and PPCS [BPS: 8.71 *vs* 4, t (df = 1,056) = 87.18, P < 0.001; PPCS: 101.10 *vs* 76, t (df = 1,056) = 67.55, P < 0.001], along with high moral incongruence (M = 4.21, SD = 1.87). This group was named as dysregulated PPU group (PPU).

The demographic characteristics and comparative analysis of PPU related indicators of different subgroups

Regarding sociodemographic characteristics, the results of the Chi-square tests indicated that latent profiles × sexual orientations (F = 0.84, P = 0.498), latent profiles × relationship status (F = 1.55, P = 0.184), latent profiles × education levels (F = 1.70, P = 0.305), and latent profiles × residence (F = 1.46, P = 0.187) did not significantly differ from each other, suggesting that no differences can be observed between male adolescents in their sociodemographic characteristics based on profile membership. Considering the three profiles as grouping variables, one-way ANOVAs and Kruskal-Wallis H-tests (when the assumptions of parametric tests were

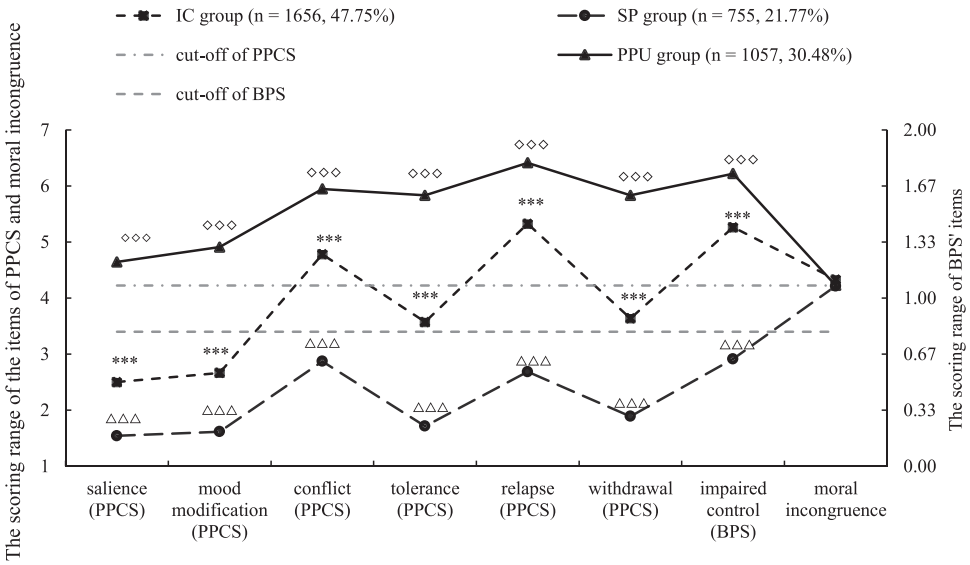

Fig. 1. Latent Classes based on the dimension of the Problematic Pornography Consumption Scale (PPCS), the Brief Pornography Screen (BPS), and moral incongruence towards pornography use (N = 3,468)

Table 2. Differences in variables related to pornography use among the 3 profiles of pornography users

Variables[a]	Total sample (N = 3,468)	Skewness	Kurtosis	① SP group (n = 755)	② IC group (n = 1,656)	③ PPU group (n = 1,057)	$F(H)$[b]	η^2	Pairwise comparisons (P < 0.001)
PPCS	70.9 ± 25.8	<0.1 (0.04)	−0.6 (0.08)	36.5 ± 10.5	67.4 ± 10.6	101 ± 12.1	1768.52***	0.82	③>②>①
BPS	6.7 ± 2.9	−0.8 (0.04)	−0.2 (0.08)	3.1 ± 2.3	7.1 ± 2.1	8.7 ± 1.8	3210.23***	0.49	③>②>①
MI	17.1 ± 7.5	−0.1 (0.04)	−1.1 (0.08)	17.4 ± 7.2	16.8 ± 7.8	16.9 ± 7.6	1.32	0.01	-
UT[c]	4 (0, 30)	2.6 (0.04)	7.5 (0.08)	2.6 (0, 30)	4 (0, 30)	6 (0, 30)	1027.74***	-	③>②>①
GHQ-12	17.6 ± 8.0	0.2 (0.04)	−0.6 (0.08)	12.7 ± 7.2	17.5 ± 7.3	21.3 ± 7.8	699.21***	0.15	③>②>①
OSA	35 (13, 109)	1.4 (0.04)	3.0 (0.08)	27 (13, 94)	35 (13, 98)	43 (14, 109)	1450.05***	-	③>②>①
SCS	27.8 ± 7.3	−0.3 (0.04)	−0.5 (0.08)	21.0 ± 6.7	27.7 ± 5.9	32.9 ± 5.3	2014.16***	0.34	③>②>①
PCQ	46.4 ± 16.7	0.3 (0.04)	−0.4 (0.08)	31.6 ± 11.7	44.8 ± 11.4	59.4 ± 15.1	2238.98***	0.36	③>②>①

Note. [a] The total score was used for data analysis; [b] H represents the Kruskal-Wallis H test results between the 3 groups; In particular, the data for the Time Spent on Pornography Weekly and the OSA were skewed; therefore, Kruskal-Wallis H test was used for these two variables to test differences between the 3 groups; [c] Weekly Time Spent on Pornography (h); PPCS, Problematic Pornography Consumption Scale; BPS, Brief Pornography Screen; MI, Moral Disapproval of Pornography Use; GHQ-12, 12-item General Health Questionnaire; OSA, Questionnaire of Online Sexual Activities; SCS, Sexual Compulsivity Scale; PCQ, Pornography Craving Questionnaire; SP group = Self-perceived Problematic group, IC group = Impaired Control group, PPU group = Problematic Pornography Use group. *** P < 0.001.

violated) were conducted on the PPU related indicators, and the results showed that there were statistically significant differences in all aspect of PPU except for the levels of moral incongruence (Table 2). The scores of the PPU group were the highest, followed by the IC group and the SP group.

Predictors of the three profiles

To examine the association between PPU and pornography-related indicators, a total of 6 nodes (variables) were included in the network analysis model, including two quantitative indicators (frequency and time spent on pornography use), and three qualitative indicators (sexual compulsivity, general mental health, and pornography craving). Results of the Markov random fields showed that there were significant differences between the SP and IC groups (P < 0.01), the SP and PPU groups (P < 0.01); but schematic diagrams of the IC and PPU groups were similar (P = 0.43). More specifically, pornography craving (r_{SP} = 0.38, r_{IC} = 0.28, r_{PPU} = 0.26) and frequency of OSAs (r_{SP} = 0.20, r_{IC} = 0.09, r_{PPU} = 0.12) showed stronger correlations with the PPCS in the SP group; but compulsive sexual behaviors had stronger correlations with the PPCS in the IC and PPU groups (r_{SP} = 0.16, r_{IC} = 0.21, r_{PPU} = 0.26) (Fig. 2).

To further explore which indicators were more strongly associated with PPU, network community was used. The

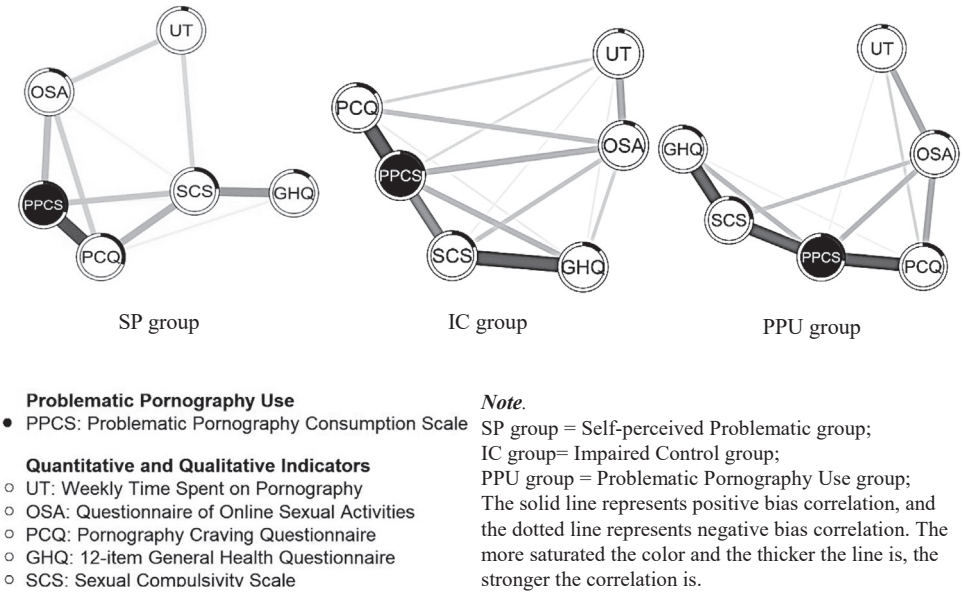

Fig. 2. Network schematic diagram in the 3 profiles of help-seeking male adolescents

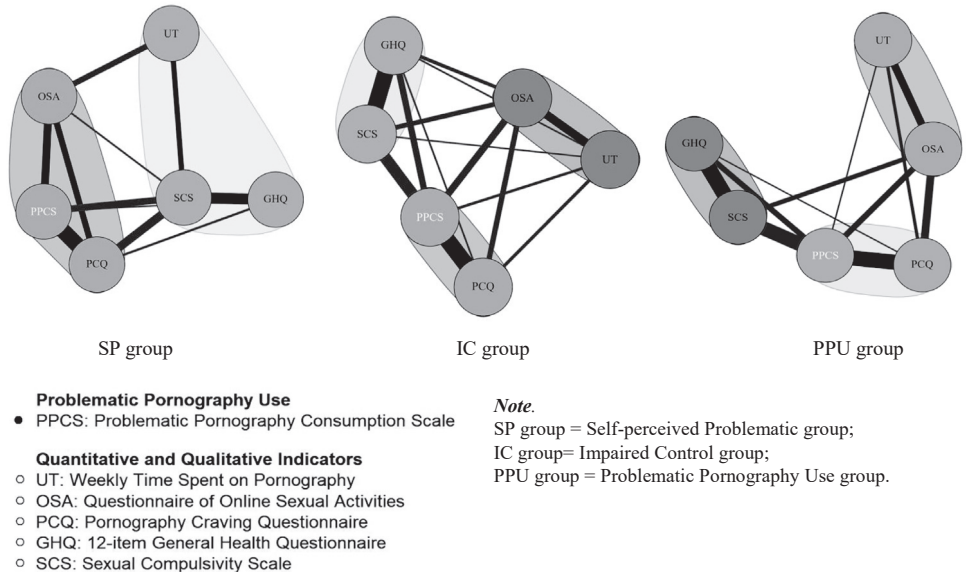

Fig. 3. Community of nodes in the 3 profiles of help-seeking male adolescents

results of the spinglass cluster detection algorithm are presented in Fig. 3. The analysis pointed to three distinct communities (i.e., clusters) of indicators in the IC and PPU groups, but aggregated into two clusters in the SP group. Noteworthily, OSAs, pornography craving, and PPCS clustered into the same community in the SP group. In the PPU and IC groups, as quantitative indicators, OSAs and time spent on pornography use grouped into the same community, and qualitative indicators, such as sexual compulsivity and general health were closer to PPU than the quantitative indicators (Fig. 3).

To evaluate the predictive power of the five aforementioned indictors on PPU among the three profiles, considering PPU as the central node, we conducted a predictable analysis. The frequency of OSAs and pornography craving were the strongest predictive indicators for the SP group, but sexual compulsivity, pornography craving, and mental health were the strongest predictive indicators in the IC and PPU groups. The frequency of OSAs demonstrated a larger explained variance in the SP group (R^2 = 12.6%), but showed lower explained variance in the IC and PPU groups (R^2_{IC} = 8%; R^2_{PPU} = 11.1%). The usage time was present at the edge of the network in all these three groups.

Core symptoms of the three profiles of help-seeking male adolescents

For the purpose of finding the core symptoms for each of the three groups, the centrality analysis model was constructed with the six dimensions of PPCS (PPU), moral incongruence, and BPS (impaired control) as nodes. Centrality plots (Fig. 4) and the results of CS coefficients showed that the betweenness of the SP group was unstable (betweenness was 0.05, lower than the acceptable criteria 0.25), so node strength and closeness were considered as the primary reference. As seen in Fig. 5, in the IC group, salience had the highest centrality, followed by mood modification. In contrast, in the SP and PPU group, besides salience and mood modification, high centrality was also observed for withdrawal.

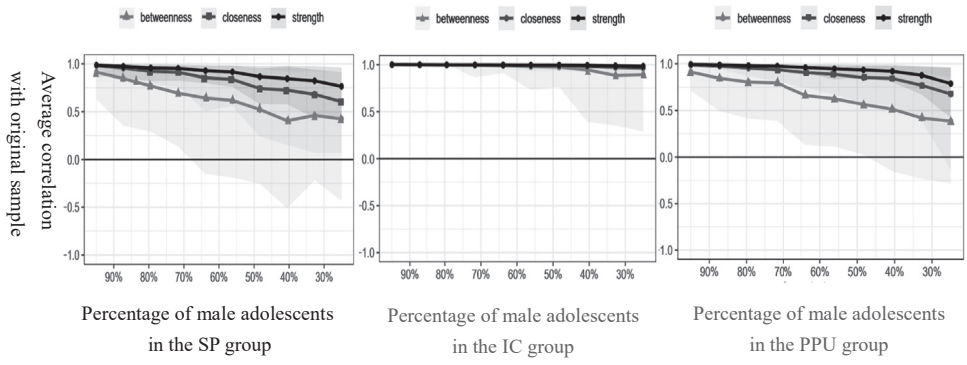

Fig. 4. Stability testing of centrality indices in the 3 profiles of help-seeking male adolescents.
Note. SP group = Self-perceived Problematic group, IC group = Impaired Control group, PPU group = Problematic Pornography Use group

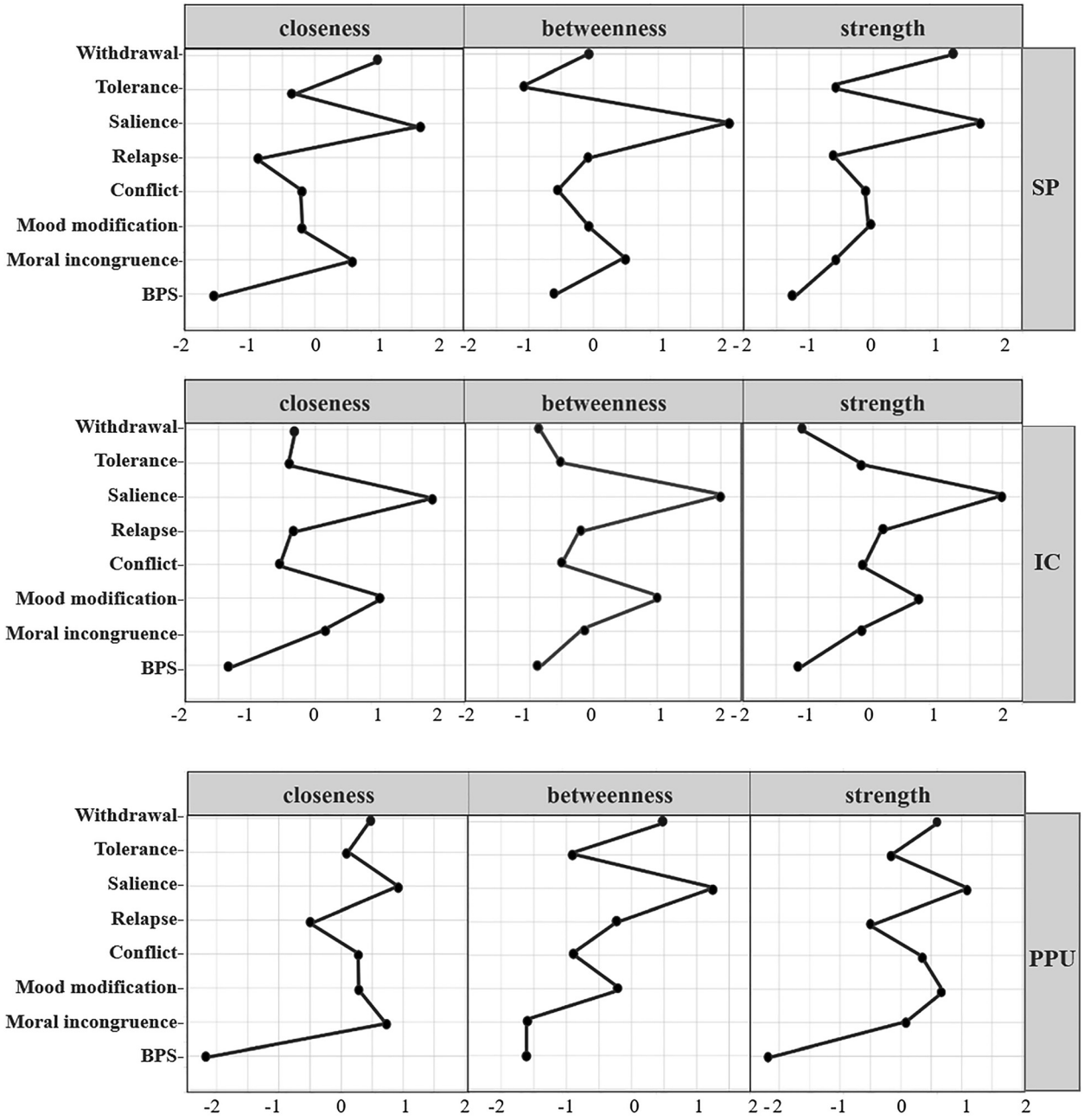

Fig. 5. Node centrality plot in the 3 groups of help-seeking male adolescents on the six dimensions of Problematic Pornography Consumption Scale, moral incongruence, and impaired control (Brief Pornography Screen = BPS).
Note. SP group = Self-perceived Problematic group; IC group = Impaired Control group; PPU group = Problematic Pornography Use group

DISCUSSION

To better assess and provide information for future intervention programs for PPU, it is essential to explore whether there are distinct sub-groups in help-seeking adolescents, and reveal the characteristics of these groups. The present study found evidence that male adolescents seeking help online for their pornography use could be divide into three groups: self-perceived PPU (n = 755, 21.8%), impaired control (n = 1,656, 47.7%) and problematic pornography use group (n = 1,057, 30.7%). In terms of indicators and predictors of PPU, frequency of OSAs and pornography craving were important for the identification of male adolescents with SP, while sexual compulsivity and mental health were more effective in identifying individuals with impaired control or dysregulated PPU. The core characteristics of SP and PPU groups were salience, withdrawal, and mood modification, while the IC group only displayed salience and mood modification as their core symptoms. These findings can help accurate screening, diagnosis, and provide essential information for interventions for excessive, out-of-control pornography use among adolescents.

In consistence with previous work (Chen, Jiang, Luo, et al., 2022; Kraus & Sweeney, 2019), not all help/treatment-seeking individuals for pornography use can be categorized and diagnosed as people with PPU, as three different subgroups may be present in help/treatment-seeking adolescents and adults (Chen, Jiang, Luo, et al., 2022), supporting the applicability of the PPMI model (Grubbs, Perry, et al., 2019) and providing empirical evidence for Kraus and Sweeney's screening algorithm (2019) in adolescents, which has not been done before in the literature.

Almost one-fourth of help-seeking male adolescents could be categorized as individuals with self-perceived problematic use, and the proportions of these individuals were similar in previous studies among adults (Chen, Jiang, Luo, et al., 2022; Kraus, Martino, & Potenza, 2016; Vaillancourt-Morel et al., 2017). These individuals did not exhibit out-of-control pornography use (i.e., did not meet the cut-off of the BPS) and did not demonstrate sexual compulsivity, yet they experienced greater feelings of conflict and relapse related in their pornography use, suggesting that their motivation to seek help might be attributed to their moral incongruence.

The IC group met the criteria of loss of control but did not meet the criteria of PPU (assessed by the PPCS), indicating that impaired control was essential to differentiate individuals with self-perceived PPU from other help-seeking male adolescents. However, the IC group did not demonstrate other crucial characteristics of PPU such as tolerance and withdrawal (de Alarcón, de la Iglesia, Casado, & Montejo, 2019; Chen, Jiang, Luo, et al., 2022). This result is in line with the proposition that unsuccessful efforts to reduce pornography use might be considered as the first step of problematic use (Bensimon, 2007). Lastly, the PPU group met the criteria of PPU, had the highest scores on all six components of the PPCS, suggesting that the pattern of loss of control was different from what could be observed in the IC group.

Noteworthy, all three groups reported high moral incongruence, and there were no significant differences in moral incongruence scores among the three groups, which may take root in the conservative cultural context in China. China is a typically conservative country in sexual attitudes (Chen, 2022; Chen, Jiang, Wang, et al., 2022; Dang, Gorzalka, & Brotto, 2019; Zhang et al., 2022), and Chinese people tend to express negative attitudes toward pornography use (Vaillancourt-Morel & Bergeron, 2019), and are more likely to feel conflicted, shame, and guilty as using pornography violates their sexual moral values (Grubbs, Wilt, Exline, & Pargament, 2018), no matter how frequent or problematic the actual pornography use is. This conjecture is supported by existing data: the average score in moral incongruence of all the three subgroups in this study was significantly higher than that of community samples from the US ($M = 2.60$), and was similar to that of the sample from Christian affiliated universities with conservative attitudes towards sex ($M = 4.60$; Grubbs et al., 2015).

Craving for pornography and frequency of OSAs were the strongest indicators in the SP group. It has been shown that pornography craving predicted short-term pornography use (Kraus & Rosenberg, 2014), suggesting that problems in this group more likely rooted in the conflict and guilt due to pornography use. In the other two groups, sexual compulsivity was the strongest predictor, which is consistent with previous findings (Kraus, Martino, & Potenza, 2016; Öberg, Hallberg, Kaldo, Dhejne, & Arver, 2017). The frequency of pornography use was at the edge of the symptom network among IC and PPU groups, which is in line with previous findings among treatment-seeking and not treatment-seeking groups of men (Bőthe, Lonza, et al., 2020), corroborating previous findings suggesting that negative symptoms, such as out of control use, or worsening intimate relationship could be better predictors of patients' treatment-seeking willingness than the quantity of pornography use (Gola, Lewczuk, & Skorko, 2016). To summarize, frequency of use should be considered when assessing PPU, but not in itself, as qualitative indicators, such as pornography craving and sexual compulsivity might be more accurate when identifying adolescents with objective behavioral dysregulation in relation to pornography use.

In terms of core symptoms of PPU, according to node strengths, salience and mood modification dimension were the most pronounced in all three groups, which were different from adults' core symptoms (Chen et al., 2021), but consistent with prior studies on adolescents, as adolescents might be more likely to be preoccupied with sexual information (Donevan & Mattebo, 2017), regardless their religiousness (Efrati, 2019). Adolescence is the crucial period of sexual consciousness development, and adolescents can be particularly concerned and curious about sexual and pornographic cues (Scott & Walsh, 2014). Moreover, adolescents' brains are still in the developmental phase, thus, they may be especially vulnerable to problematic pornography use (Donevan & Mattebo, 2017). Unlike adults, adolescents might lack sufficient maturation and integrity in frontal cortices necessary to exert cognitive control required to suppress sexual cravings, thoughts, and behaviors elicited by pornographic content (Owens et al., 2012).

A unique finding of this study was that mood modification was a core feature of adolescents' PPU. In previous study, teenagers scored higher on mood modification than other factors of PPU (Bőthe, Vaillancourt-Morel, et al., 2021), and one of their main motivations for online sexual experience was mood management (Castro-Calvo, Giménez-García, Gil-Llario, & Ballester-Arnal, 2018). Combining with the high score in moral incongruence, the finding may suggest that there could be a cyclical pattern of pornography use: pornography use may decrease the stress and modify the negative mood, but adolescents may encounter shame, regret, and self-accusation (Sassover et al., 2021), which results in more pornography use to escape shame and guilt. However, these potential hypotheses warrant further investigation.

Closeness and strength showed that withdrawal was another core symptom in the SP and PPU groups. Our findings are in line with the two-stage model of addiction. This model stated that the first stage is characterized by compulsive dependence or even loss of control of substances or behaviors. The second stage is characterized by withdrawal difficulties, repeated failures, and the inability to stop

even after suffering substantial negative consequences (Bensimon, 2007). The IC group may be in a compulsive state of addiction to pornography, with no apparent withdrawal symptoms. In contrast, the PPU group showed intense withdrawal and repeated abstinence but failed, supporting this theoretical model. As for those individuals with self-perceived problems, they did not appear out of control but have intense cravings for pornography and moral guilt on use, and thus they labelled themselves as "addicted" and "problematic". Previous studies showed that individuals who considered themselves as problematic users were more sensitive to pornographic cues and were more likely to be sexually aroused and crave pornography, regardless of whether there is a behavioral disorder or dysregulation (Mechelmans et al., 2014), which may enhance the importance of pornography to them and make them more stressed or agitated when they are unable to watch pornography, leading to the experience of withdrawal.

Implications

Firstly, this study suggested that adolescents may display similar and different symptomatology as adults. Thus, it would be important to conduct more studies on adolescents' pornography use and PPU symptoms as well. Secondly, according to the characteristics of the subgroups of help-seeking male adolescents, it is crucial to understand each client's reasons for seeking help and plan interventions targeted for their specific issues. Thirdly, quantitative and qualitative indicators play different roles in screening different subgroups, which indicate it may be reasonable to screen PPU with more complex batteries including behavioral dysregulation and not only the quantity of pornography use. Lastly, the study was conducted in China and recruited Chinese adolescence. Most prior studies were conducted in Western, Educated, Industrialized, Rich, and Democratic countries (Grubbs et al., 2020; Grubbs & Kraus, 2021; Klein, Savaş, & Conley, 2021), so this study can further our understanding in other countries and cultural contexts which is almost completely missing from the literature.

LIMITATIONS

There are some limitations of this study that need to be mentioned. The data were self-reported by the participants, which may be prone to self-report and self-selection bias. Furthermore, this study only recruited help-seeking male adolescents, whether the 3 potential profiles also exist in the help-seeking female adolescents or gender diverse individuals, and whether they show similar characteristics with male adolescents is worth further exploration in the future (e.g., Klein et al., 2021). Further longitudinal studies also be encouraged to explore the stability of different profiles of PPU and the factors that may drive a shift in these sub-groups. Finally, pornography craving demonstrated the strongest correlation with PPU in the SP groups. Thus, it would be necessary to include not only pornography craving but also sexual desire in future studies to have a better understanding whether craving or sexual desire might be related to self-perceived pornography addiction.

CONCLUSION

Similarly to adult help-seeking men, help-seeking male adolescents could be divided into three profiles, namely, self-perceived problematic group, impaired control group and problematic pornography use group. Frequency of OSAs was important in identifying male adolescents with self-perceived problematic use/addiction, while correlates, such as pornography craving, sexual compulsivity, and mental health were more effective in identifying individuals with objective behavioral dysregulation (i.e., individuals with impaired control or dysregulated PPU). Salience and mood modification were shared as core characteristics of all three subgroups, while the SP and PPU groups also showed withdrawal symptoms. The findings of the present study suggest that more attention should be paid to adolescents seeking help for their pornography use, and it would be essential to target and provide intervention to help-seeking adolescents in a more personalized manner focusing on their pornography use-related characteristics.

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SUPPLEMENTARY MATERIALS

Supplementary data to this article can be found online at https://doi.org/10.1556/2006.2022.00065.

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