Modelling the contribution of metacognitions, impulsiveness, and thought suppression to behavioural addictions in adolescents

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Article

Modelling the contribution of metacognitions, impulsiveness, and thought suppression to behavioural addictions in adolescents

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Abstract: The most common behavioral addictions in adolescents are Internet Gaming Disorder (IGD), Compulsive Sexual Behavior Disorder (CSBD), and problematic social networks use (PSNU). In the present study, we investigated whether thought suppression and impulsiveness mediate the relationship between metacognitions and these three behavioral addictions (IGD, CSBD and PSNU). In Study 1 (n = 471), we examined whether online gaming thought suppression and impulsiveness mediate the relationship between metacognitions and IGD. In Study 2 (n = 453), we examined whether sex thought suppression and impulsiveness mediate the relationship between metacognitions and CSBD. In Study 3 (n = 1004), we examined whether social media thought suppression and impulsiveness mediate the relationship between metacognitions and PSNU. Results of path analysis indicated, across the three studies, the importance of both thought suppression and impulsiveness as mediators between metacognitions and the three behavioral addictions (IGD, CSBD and PSNU) being investigated. These findings provide an opportunity for therapists as well as educators to gain a better insight into the link between metacognitions, thought suppression, impulsiveness, and behavioral addictions as part of developmental behavior among adolescents.

Keywords: Adolescents; Compulsive Sexual Behavior Disorder; impulsiveness; Internet Gaming Disorder; metacognitions; problematic social networks use; thought suppression

1. Introduction

Behavioral addictions are a constellation of recognizable and clinically significant syndromes characterized by distress or interference with personal functions that develop consequently to the engagement in repetitive rewarding behaviors other than the use of dependence-producing substances (World Health Organization, 2018). Individuals who present with behavioral addictions are chronic manifestations including craving, tolerance, impulsiveness, and withdrawal symptoms, which ultimately result in numerous adverse consequences, including financial difficulties, incarceration, family disharmony, and impaired social relationships (Yau & Potenza, 2015). In adolescents the most common behavioral addictions are Internet Gaming Disorder (IGD) (Paulus, Ohmann, Von Gontard, & Popow, 2018), Compulsive Sexual Behavior Disorder (CSBD) (Efrati & Dannon, 2018; Efrati and Gola, 2018) and problematic social networks use (PSNU) (Andreassen, 2015; Li et al., 2020; Ryan, Chester, Reece, & Xenos, 2014).

IGD refers to a pattern of gaming behavior characterized by impaired control over gaming, increasing priority given to gaming over other activities, and continuation of gaming despite the occurrence of negative consequences that result in personal, familial, social, and occupational impairments for more than 12 months (WHO, 2018). CSBD is defined as an impulse-control disorder characterized by a repetitive and intense preoccupation with sexual fantasies, urges, and behaviors, leading to clinically significant distress or impairment in social and occupational functioning and to other adverse consequences (ICD-11; Gola & Potenza, 2018b; Kafka, 2010; WHO, 2018). Although ICD-11 does not classify CSBD (classification number 6C72) as a behavioral addiction (Kraus et al., 2018), several scholars have conceptualized it as an addictive behavior (Kraus, Voon, & Potenza, 2016; Potenza, Gola, Voon, Kor, & Kraus, 2017). Addictions typically comprise activities conducted repeatedly, habitually, and compulsively and interfere in major areas of life functioning (Miller, Forcehimes, & Zweben, 2011). They may involve chronic relapsing, feelings of tension or arousal before committing the act, and subsequent pleasure, gratification, or relief at the time of committing the act. Behaviors often become less pleasurable and more habitual over time. They may be driven by negative reinforcement and involve craving states (Grant, Potenza, Weinstein, & Gorelick, 2010). CSBD parallels these tendencies in various ways: individuals with CSBD often develop anxiety and depression symptoms when not engaging in sexual behavior (e.g., Wines, 1997) and also report difficulties in attempting to stop or reduce the frequency of sexual activities (Bothe et al., 2020).

PSNU refers to problems related to the drastic increase in use of online social networking (Hormes, Kearns, & Timko, 2014) that share several characteristics relating to the development of addictive behaviors, including reinforcement schedules from new material posted online and the presence of classically conditioned cues, such as mobile notifications about the availability of new content. In addition, physiological arousal, and activation of appetitive pathways in response to social networks use, resemble those observed in other types of behavioral addiction, supporting the potential inclusion of problems related to social networks use in the category of non-substance addictions (Kuss & Griffiths, 2011; Wise, Alhabash, & Park, 2010).

The prevalence among adolescents of IGD ranges between 7% and 15% (Pontes et al., 2019), of CSBD between 12% and 18% (Efrati & Dannon, 2018), and of PSNU between 13% to 15% (Li et al., 2020). Several factors have been highlighted as important in understanding the etiology of behavioral addictions. In the current study, we focus on thought suppression and impulsiveness.

1.1. *Thought suppression and impulsiveness in addictive behaviors*

Thought suppression is a mental control strategy characterized by attempts to manage emotional distress by keeping unwanted thoughts out of awareness (Wenzlaff & Wegner, 2000). A common strategy to handle unwanted thoughts is to try to suppress them (e.g., Brockman, Ciarrochi, Parker, & Kashdan, 2017), particularly if a person cannot openly share these thoughts with others (Gross & John, 2003). The engagement in thought suppression, however, can paradoxically lead to an increase in the suppressed thought – i.e., a rebound effect (Abramowitz, Tolin, & Street, 2001; Wenzlaff & Luxton, 2003). This effect has been observed in various addictive and addictive-like behaviors among adolescents and adults such as CSBD (Efrati, 2019; Efrati, Kolubinski, Caselli, & Spada, 2020), PSNU (Hormes , Kearns, & Timko , 2014), IGD (Gong , Chen, & lee, 2020), alcohol use (Klein, 2007), cigarette use (Erskine et al., 2012) and pathological gambling (Riley, 2014), which suggests that there is a transdiagnostic role for thought suppression in addictive behaviors (Spada, Caselli, Nikcevic, & Wells, 2015).

Impulsiveness is broadly defined as the tendency toward rapid, poorly considered, and disinhibited decisions and actions (Dalley, Everitt, & Robbins, 2011; Zhang et al., 2020). Similarly to thought suppression impulsiveness has also been associated with various addictive and addictive-like behaviors among adolescents and adults including CSBD (Bothe et al., 2019, Efrati et al., 2020, Wetterneck et al., 2012), PSNU (Wegmann, Müller, Turel, & Brand, 2020), IGD (Fumero et al., 2020), alcohol consumption (Castellani

& Rugle, 1995), and compulsive eating (Hartmann et al., 2010). A recent systematic meta-review concluded that impulsiveness may be considered as a core process that underpins substance and behavioral addictions (Lee, Hoppenbrouwers, & Franken, 2019). With that being said, the association between impulsiveness and CSBD is less reliable as compared with IGD and PSNU, with several studies indicating no significant associations between the construct (e.g. Efrati & Gola, 2019; Efrati, Shukron, & Epstein, 2019). In the current study, we, therefore hypothesized that thought suppression and impulsiveness would be positively correlated with IGD, and PSNU and with lesser extent with CSBD.

1.2. Metacognitions as drivers of thought suppression and impulsiveness

Although thought suppression and impulsiveness have been highlighted as important in the prediction of various behavioral addictions among adolescents and adults, limited studies have been undertaken on exploring the antecedents of thought suppression and impulsiveness, especially among adolescents. In this research, we examine one key factor that might serve as the driving force behind thought suppression and impulsiveness – metacognitions.

Metacognition can be defined as any stable knowledge about one's own cognitive system and strategies that may have an impact on the regulation of cognition, the awareness of the current state of cognition, and the appraisal of the meaning of cognitive-affective states (Wells & Matthews, 1996). According to Wells and Matthews' metacognitive model of psychological distress (Wells & Matthews, 1994; 1996) metacognitions (beliefs about cognition) are involved in the activation of maladaptive coping strategies (rumination, worry, increased attention to threat and thought suppression) that bring to an exacerbation of negative affect. This, in turn, increases the likelihood of engaging in addictive behaviors as an escapism and 'last resort' for achieving cognitive-affective self-regulation (Spada, Caselli, Nikcevic, & Wells, 2015; Spada, Proctor, Caselli, & Strodl, 2013).

Cartwright-Hatton and Wells (1997; Wells & Cartwright-Hatton, 2004) were the first researchers to assess metacognitions through the Metacognitions Questionnaire (MCQ; Cartwright-Hatton & Wells, 1997) and the Metacognitions Questionnaire 30 (MCQ-30; Wells & Cartwright-Hatton, 2004), which consist of five factors: (i) positive beliefs about worry (e.g., "If I worry I will be solve the problem"); (ii) negative beliefs about thoughts concerning danger and uncontrollability (e.g., "My thoughts are out of control and may harm me"); (iii) cognitive confidence (e.g., "I don't trust my judgement"); (iv) beliefs about the need to control thoughts (e.g., "I need to control my thoughts at all times"; and (v) cognitive self-consciousness (e.g., "I play close attention to how my mind works").

A large body of research suggests that metacognitions are implicated in all psychological problems (for a review, see Wells, 2013). A recent systematic review by Hamonniere and Varescon (2018) has also identified that metacognitions are predictive of addictive behaviors in adults. Research, for example, has found that all five dimensions of the MCQ/MCQ-30 are positively correlated with the severity of alcohol use, nicotine use, gambling, and problematic Internet use (Akbari, 2017; Jauregui, Urbiola & Estevez, 2016; Lindberg, Fernie & Spada, 2011; Mansueto et al., 2016; Marino et al., 2016; Moneta, 2011; Nikčević & Spada, 2008; Spada et al., 2008; Spada & Marino, 2017; Spada et al., 2007; Spada & Roarty, 2015; Spada & Wells, 2005; Spada, Zandvoort & Wells, 2007). These studies also indicated that among the five metacognitions factors, cognitive confidence, and beliefs about the need to control thoughts emerged as the strongest predictors of severity of addictive behavior and category membership as suffering from an addictive behavior over and above negative affect. More recently research has also indicated that metacognitions predict both problematic social networks use and IGD in adolescents (Aydın, Güçlü, Ünal-Aydın, & Spada, 2020; Marino et al., 2019).

In the current study, and in line with the metacognitive model of psychological distress, we hypothesized that metacognitions would be positively correlated with both thought suppression and impulsiveness. According to this model, metacognitions should lead to the activation of maladaptive forms coping strategies (thought suppression) as well as to a greater likelihood of being impulsive because of the paradoxical effect of

engaging in mental control strategies (thought suppression, worry, rumination) that are likely to increase the salience of unwanted thoughts. Research has supported this premise by indicating that negative metacognitions are indeed associated with impulsiveness but not with sensation seeking (e.g., Miller, Walshe, McIntosh, Romer, & Winston, 2021) and with the activation and maintenance of coping strategies such as thought suppression (see Hamonniere & Varescon, 2018 for a systematic review).

1.3. Possible confounding effects for religiosity and gender in behavioral addictions

Aside from examining the proposed model in which metacognitions lead to thought suppression and impulsiveness, which in turn are associated with IGD, CSBD and PSNU, in the current research we also examine whether the model stands after controlling for two background measures that were found to play a key role in addictive behaviors – religiosity and gender. Religion is often seen as a buffer or vanguard against addictive behavior of diverse origin (Gomes, de Andrade, Izbicki, Almeida, & de Oliveira, 2013; Hodge, Andereck, & Montoya, 2007; Montgomery, Stewart, Bryant, & Ounpraseuth, 2014). In some aspects of life, however, religious beliefs may promote an inner struggle that might sustain an addictive behavior (Faigin, Pargament, & Abu-Raiya, 2014). According to the moral incongruence model of problematic pornography use (Grubbs et al., 2019; Grubbs & Perry, 2019), for example, there is an incongruence between religious adolescents' normal sexual desires and the explicit moral standards against sexual-related thoughts and behaviors imposed by religious figures (e.g., the Jewish rabbi) and texts (e.g., the Bible and the Jewish Talmud). In keeping with this incongruence, several studies have shown that religious adolescents have higher levels of CSBD as compared with secular adolescents (e.g., Efrati, 2018a, 2019a, 2019b). These studies, however, were all conducted on Jewish populations (although Christianity and Islam share common negative views regarding expressing openly sexual behaviors) and so future studies should examine the robustness of these findings in other religions. Of note, to date, the relationship between religiosity, IGD and PSNU use has not been examined among adolescents (Grubbs & Grant, 2020). Only one study found an association between religiosity and online gaming behavior among young adults (ages 17-31; Braun, Kornhuber, Lenz, & Cohort Study on Substance Use Risk Factors, 2016), and also identified that religiosity was linked with lower levels of gaming in general and lower risk for excessive/addictive gaming.

Gender differences are also common in behavioral addictions. For example, research indicates that boys are exposed to pornography at earlier age than girls, consume more pornography and tend more often to self-define themselves as addicted to pornography (see Kowalewska, Gola, Kraus, & Lew-Starowicz, 2020, and Peter & Valkenburg, 2016 for a recent reviews). In addition, boys have higher attentional bias toward sexual cues and tend to have higher prevalence of CSBD (e.g., Efrati & Gola, 2018a; Efrati, Kolubinski, Caselli, & Spada, 2020). Similarly, studies on IGD have shown a higher prevalence in boys (Griffiths, Kuss, & King, 2012; Lee et al., 2013; Sasmaz et al., 2014; Sugaya, Shirasaka, Takahashi, & Kanda, 2019). Most studies report that boys have a 2–3 times greater risk of IGD than girls (Lee, Han, Kim, & Renshaw, 2013; Sasmaz et al., 2014), with 4.1% of men and 3.2% of women reported as problematic players (Festl, Scharkow, & Quandt, 2013). Conversely, some studies suggest that girls prefer to use the Internet for communication and boys for game playing (Mihara & Higuchi, 2017), and indeed PSNU has been shown to be more prevalent in girls than boys (Peris, de la Barrera, Schoeps, & Montoya-Castilla, 2020).

1.4. Aims of the study

The aim of the current study is to extend our understanding of the interlink between metacognitions, thought suppression, impulsiveness and three behavioral addictions (IGD, CSBD, and PSNU). We did this by testing a model where metacognitions predict both thought suppression and impulsiveness which in turn predict the behavioral addictions (see Figure 1). We did so while controlling for gender and religiosity. We hypothesized that: (1) metacognitions would be positively correlated with thought suppression

and impulsiveness; and (2) thought suppression and impulsiveness would be positively correlated with IGD, CSBD, and PSNU. To do so, we conducted a series of three studies on a total of 1,930 adolescents.

2. Study 1

We designed Study 1 to examine whether thought suppression and impulsiveness mediate the association between metacognitions (positive beliefs about worry, negative beliefs about thoughts concerning danger and uncontrollability, cognitive confidence, beliefs about the need to control thoughts, and cognitive self-consciousness) and IGD, such that higher metacognitions would be associated with higher thought suppression and impulsiveness, which in turn would be linked with greater severity of IGD.

2.1. Method

2.1.1. Participants

A convenience sample of 474 adolescents (283 females; mean age = 15.73 years [SD = 1.31; range 14 to 18 years]) was recruited for this study and completed a battery of questionnaires online. Of the total sample, 23% classified themselves as secular, 25.5% classified themselves as traditional, 50.2% classified themselves as religious and 1.3% classified themselves as ultra-orthodox. Regarding religious affiliation, a dichotomous variable was created by combining 'Secular' and 'Traditional' under the variable 'low religious affiliation' and 'Religious' and 'Ultra-Orthodox' as 'high religious affiliation'.

2.1.2. Self-report measures

Metacognitions.

The Metacognitions Questionnaire 30 (MCQ-30; Wells & Cartwright-Hatton, 2004) is a 30-item self-report measure that assesses generic metacognitions in psychopathology using a 4-point Likert scale (1 = "Do not agree" and 5 = "Agree very much"). Five factors are assessed, which include: (a) positive beliefs about worry (POS); (b) negative beliefs about thoughts concerning danger and uncontrollability (NEG); (c) cognitive confidence (CC); (d) beliefs about the need to control thoughts (NC); and (e) cognitive self-consciousness (CSC). Higher scores indicate higher levels of metacognitions. The MCQ-30 has demonstrated good internal consistency and convergent validity and has acceptable test-retest reliability (Spada, Mohiyeddini, & Wells, 2008; Wells & Cartwright-Hatton, 2004). In this study, Cronbach's alpha was .88.

Impulsiveness.

The Barratt Impulsiveness Scale-11 (BIS-11; Patton, Stanford, & Barratt, 1995; translated to Hebrew by Glicksohn, Leshem & Aharoni, 2006) is a 30-item self-report measure that assesses impulsiveness using a 4-point Likert scale (1 = Rarely/Never and 4 = Almost always/Always). Three factors are assessed: attentional impulsiveness (e.g., "I get easily bored when solving thought problems"), motor impulsiveness (e.g., "I do things without thinking") and non-planning impulsiveness (e.g., "I am more interested in the present than the future"). Higher scores indicate higher levels of impulsiveness. There is evidence to suggest that these three factors are not clearly defined across cultures (Vasconcelos, Malloy-Diniz, & Correa, 2012). Patton and colleagues (1995) report internal consistency coefficients for the BIS-11 total score that range from .79 to .83 for various clinical and non-clinical populations. In this study, Cronbach's alpha was .80.

Thought suppression.

A version of the Food Thought Suppression Inventory (FTSI; Barnes, Fisak, & Tantleff-Dunn, 2009) was adapted for this study by back-to-back translation procedure (from English to Hebrew and back). For each of the references to thoughts about food, the authors substituted these with thoughts about Internet gaming. The Thought

Suppression Inventory is a 15-item unidimensional self-report measures that assesses the tendency to avoid Internet gaming-related thoughts (e.g., "There are images about Internet gaming that come to mind that I cannot erase") using a 5-point Likert scale (1 = Strongly disagree and 4 = Strongly agree). Higher scores indicate higher levels of thought suppression. Cronbach's alpha was reported as .96 in a population of women (Barnes et al., 2009) and .95 in a population of men (Barnes & White, 2010). In this study, Cronbach's alpha was .94.

Internet Gaming Disorder.

The severity of IGD and its detrimental effects over a 12-month period were assessed using a version of the nine-item (short form) of the Internet Gaming Disorder Scale (IGDS9-SF; Pontes & Griffiths, 2015) based on the nine IGD DSM-5 items (American Psychiatric Association [APA], 2013). Items were translated into Hebrew by a speaker proficient in both languages and then back translated by the first author. Responses are rated on a 5-point scale (ranging from 1 = Never to 5 = Very often). Responses were averaged such that higher scores represent a higher internet gaming disorder severity. In this study, Cronbach's alpha was .94.

2.2. Procedure

The study was approved by Beit-Berl's Institutional Review Board (IRB). Participants were recruited by postings on bulletin boards and online forums for volunteers for research on internet gaming among 14- to 18-year-old adolescents. The study questionnaires were uploaded to Qualtrics (Qualtrics, 2019). After adolescents responded and agreed to participate, their parents were contacted (by e-mail and/or phone) and were asked to review the questionnaires. If the parents approved, they were asked to sign an informed parental consent form and e-mail it to a research assistant. Following parental consent, a link for the online survey was sent to the adolescent, who was assured of the anonymity of the study. Participants were then asked to complete the survey at home, without anyone else present in the following order: metacognitions, impulsiveness, thought suppression, internet gaming disorder and socio-economic background measures. Each adolescent was asked to sign an informed consent form prior to beginning the study. Once the study had been completed, the researchers followed up with the adolescents with an online debriefing. Finally, the participants were thanked for taking part in the research.

2.3. Data analysis

Bivariate correlations among the variables were calculated using SPSS (version 25; IBM Corp, 2017). A series of Shapiro-Wilk normality tests indicated that all of the variables were non-normally distributed at the $p < .001$ level. Accordingly, all correlations were conducted using Spearman's Rho (see Table 1). Gender was scored such that a positive correlation demonstrated higher scores among females and a negative correlation represented higher scores in males.

Then, the pattern of relationships specified by our theoretical model (Figure 1) was tested using path analyses. Specifically, the Lavaan package (Rosseel, 2012) of software R (R Development Core Team 2018) and a single observed score for each construct included in the model were used. The Robust Maximum Likelihood method estimator (MLR; Satorra & Bentler, 1994) was used, because several variables were non-normally distributed. The Sobel test (Baron & Kenny, 1986; Hayes, 2009) was used to test for mediation. R^2 of each endogenous variable and the Total Coefficient of Determination (TCD; Bollen, 1989; Jöreskog & Sörbom, 1996) were considered in order to evaluate the goodness of fit of the model. In the tested models, internet gaming disorder was the outcome variable, impulsiveness and thought suppression were the mediators, and the five MCQ-30 metacognitions (i.e., positive beliefs about worry, negative beliefs about thoughts concerning danger and uncontrollability, cognitive confidence, beliefs about the need to control thoughts, and cognitive self-consciousness) were the independent variables, whereas age,

gender, and religious affiliation (low vs. high) were included as control variables on the two mediators and the outcome (Figure 1).
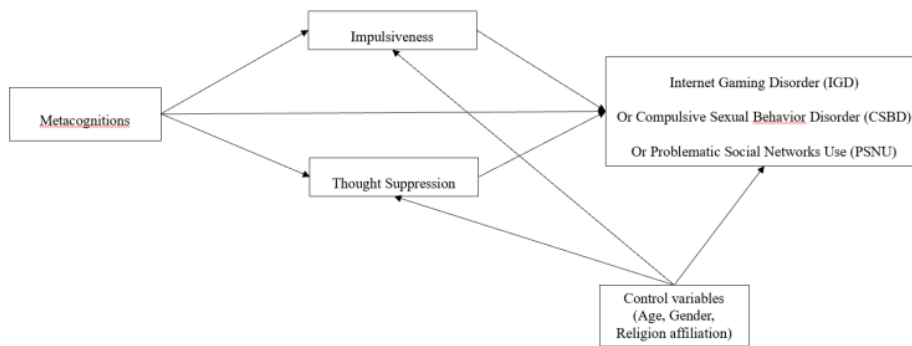

Figure 1. Hypothesized theoretical model.

In order to select the most plausible model, the full model was first tested. Subsequently, path coefficients not significant at the 5% level were removed step-by-step. For sake of brevity, Figure 2 shows the final model including significant path coefficient only.
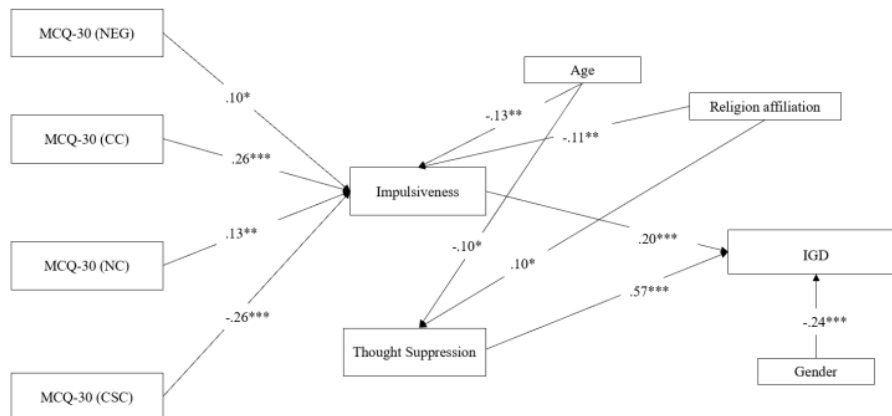

Figure 2. Results of the path analytical model with IGD as outcome variable. Notes: *$p<0.05$, **$p<0.001$, ***$p<0.001$; N=471; Religious Affiliation = (1= Low, 2= High); Gender: 1= M, 2= F; MCQ-30 (NEG) = Metacognitions Questionnaire-30 (Negative Beliefs about Thoughts concerning Uncontrollability and Danger); MCQ-30 (CC) = Metacognitions Questionnaire-30 (Cognitive Confidence); MCQ-30 (NC) = Metacognitions Questionnaire-30 (Beliefs about the Need to Control Thoughts); MCQ-30 (CSC) = Metacognitions Questionnaire-30 (Cognitive Self-Consciousness); BIS = Barret Impulsivity Scale; TSI = Thought Suppression Inventory; IGD = Internet Gaming Disorder.

2.4. Results

2.4.1. Bivariate correlations

Table 1 shows the descriptive statistics for the variables and the bivariate correlations between the variables included in this study. IGD was strongly correlated with thought suppression (r_s = .67, $p < .001$) and had a weak correlation with impulsiveness (r_s = .28, $p <$

.001), gender ($r_s = -.26$, $p < .001$), cognitive confidence ($r_s = .22$, $p < .001$), beliefs about the need to control thoughts ($r_s = .17$, $p < .001$), negative beliefs about thoughts concerning uncontrollability and danger = .15, $p < .001$), positive beliefs about worry ($r_s = .12$, $p < .001$) and religiosity ($r_s = .10$, $p < .001$).

Table 1. Means, standard deviations and bivariate correlations with outcome variables across each study.

	IGD N = 471-474	CSBD N = 453	PSNU N = 1003
1. Gender			
Correlation	-.26**	-.28**	.13**
2. Age			
Correlation	-.09*	-.09	.05
3. Religious Affiliation			
Correlation	.10*	.15**	.09**
4. MCQ-30 (POS)			
Mean	12.14	12.55	12.17
Standard Deviation	3.97	4.04	3.99
Correlation	.12*	.15**	.15**
5. MCQ-30 (NEG)			
Mean	13.09	13.07	13.26
Standard Deviation	4.55	4.51	4.49
Correlation	.15**	.14**	.15**
6. MCQ-30 (CC)			
Mean	11.15	10.95	11.05
Standard Deviation	4.46	4.16	4.35
Correlation	.22**	.24**	.15**
7. MCQ-30 (NC)			
Mean	13.50	13.06	13.45
Standard Deviation	3.57	3.51	3.61
Correlation	.17**	.28**	.13**
8. MCQ-30 (CSC)			
Mean	16.95	16.70	16.72
Standard Deviation	3.86	4.11	4.03
Correlation	.17**	.04	.04
9. BIS			
Mean	65.67	66.84	67.33
Standard Deviation	10.05	10.55	11.24
Correlation	.28**	.29**	.21**
10. TSI			
Mean	26.48	37.13	32.83
Standard Deviation	12.70	14.97	14.31
Correlation	.68**	.68**	.32**

Note: Age = Age in Years; MCQ-30 (POS) = Metacognitions Questionnaire-30 (Positive Beliefs about Worry); MCQ-30 (NEG) = Metacognitions Questionnaire-30 (Negative Beliefs about Thoughts concerning Uncontrollability and Danger); MCQ-30 (CC) = Metacognitions Questionnaire-30 (Cognitive Confidence); MCQ-30 (NC) = Metacognitions Questionnaire-30 (Beliefs about the Need to Control Thoughts); MCQ-30 (CSC) = Metacognitions Questionnaire-30 (Cognitive Self-Consciousness); BIS = Barret. Impulsivity Scale; TSI = Thought Suppression Inventory; IGD = Internet Gaming Disorder; CSBD = Compulsive Sexual Behavior Disorder; PSNU = Problematic Social Networks Use. *n* 453 to 1003; *p < .05; **p < .01.

2.4.2. Path analysis: Do thought suppression and impulsiveness mediate the association between metacognitions and IGD?

The model was run on a final sample of *n* = 471 adolescents (as 3 participants of the total sample of *n* = 474 did not complete one or more questionnaires). Negative beliefs about thoughts concerning uncontrollability and danger, cognitive confidence, and beliefs about the need to control thoughts were directly and positively associated with impulsiveness, whereas none of the five metacognitions was associated with thought suppression. However, thought suppression was strongly and positively associated with IGD along with impulsiveness. As regard the control variables, religious affiliation was positively associated with thought suppression and negatively associated with impulsiveness,

whereas gender was negatively associated with IGD, and age was negatively associated with both the mediators (impulsiveness and thought suppression) (Figure 2). With regard to indirect relationships, results of the Sobel test did not support the mediating role of impulsiveness between negative beliefs about thoughts concerning uncontrollability and danger and IGD (β = .021, SE =.018, z = 1.929, p =.054) but did support the mediating role of impulsiveness between: (i) cognitive confidence and IGD (β = .053, SE =.024, z = 3.610, p < .001); (ii) beliefs about the need to control thoughts and IGD (β = .027, SE =.023, z = 2.381, p = .017); and (iii) cognitive self-consciousness and IGD (β = -.052, SE =.025, z = -4.052, p < .001). No mediation paths were observed regarding thought suppression.

With regard to model fit, the model accounted for 42% of the variance of IGD, and 19% of the variance of one mediator (i.e., impulsiveness) variable. Substantial lower variance was observed for the other mediator (thought suppression, i.e., 2%). Finally, the total amount of variance explained by the model (Total Coefficient of Determination, TCD = .28) indicated an acceptable fit to the observed data. Indeed, this TCD corresponds to a correlation of r = .53, which can be considered a large effect size (Cohen, 1988).

2.5. Discussion

Recently, research has indicated that metacognitions are linked with IGD among adolescents (Aydın, Güçlü, Ünal-Aydın, & Spada, 2020; also see Marino & Spada, 2017 for a narrative review). Specifically, by assessing 515 Turkish adolescents aged 13.2 years, on average, the researchers found that metacognitions were linked with all the facets of IGD (the salience, mood modification, tolerance, withdrawal symptoms, conflict, and relapse of the disorder). In addition, metacognitions were associated with impulsiveness (Miller et al., 2021) and with the activation and maintenance of thought suppression (Hamonniere & Varescon, 2018). In Study 1, we found support to the hypothesis that impulsiveness would mediate the association between metacognitions and IGD. Specifically, we found that lack of confidence in one's mnemonic and attentional capabilities, beliefs about the need to control thoughts, and lack of cognitive self-consciousness, which reflects less monitoring of thinking processes, were associated with higher impulsiveness; higher impulsiveness, in turn, was linked with higher severity of IGD. These results are partially in keeping with Hamonniere and Varescon's (2018) as well as Sun and colleagues' (2017) observations that beliefs about the need to control thoughts, and a lack of cognitive confidence are two of the metacognitions closely associated with addictive behaviors.

Conversely, although the Self-Regulatory Executive (S-REF, Wells & Matthews, 1994; CAS; Wells, 2000, 2013; Wells & Matthews, 1994) models propose that metacognitions should be linked with the activation and maintenance of thought suppression, Study 1 did not reveal significant associations between metacognitions and thought suppression. One possible reason for the lack of association is that we did not assess adolescents' overall tendency to suppress their thoughts but asked specifically about Internet gaming-related thought suppression. Because adolescents find Internet gaming as enjoyable and fulfilling, they might show less of a tendency to suppress thoughts related to excessive gaming. To examine this possibility and to explore our model in greater depth, we designed Study 2 in which we examined whether impulsiveness and thought suppression mediate the association between metacognitions and a behavioral addiction that more often incurs negative effects among adolescents and adults – CSBD.

3. Study 2

We designed Study 2 to examine whether thought suppression and impulsiveness mediate the association between metacognitions (positive beliefs about worry, negative beliefs about thoughts concerning uncontrollability and danger, cognitive confidence, beliefs about the need to control thoughts, and cognitive self-consciousness) and CSBD, such that higher metacognitions would be associated with higher thought suppression and impulsiveness, which in turn would be linked with greater severity of CSBD.

3.1. Method

3.1.1. Participants

A convenience sample of 453 adolescents (256 females; mean age = 16.26 years [SD = 1.23; range 14 to 18 years]) was recruited for this study and completed a battery of questionnaires online. Of the total sample, 39.1% classified themselves as secular, 25.4% classified themselves as traditional, 34.7% classified themselves as religious and 0.9% classified themselves as ultra-orthodox. As above, a dichotomous variable was created for religious affiliation by combining 'Secular' and 'Traditional' under the variable 'low religious affiliation' and 'Religious' and 'Ultra-Orthodox' as 'high religious affiliation'.

3.1.2. Self-report measures

Metacognitions.

The Metacognitions Questionnaire 30 (MCQ-30; Wells & Cartwright-Hatton, 2004) was used as in Study 1. In this study, Cronbach's alpha was .88.

Impulsiveness.

The Barratt Impulsiveness Scale-11 (BIS-11; Patton, Stanford, & Barratt, 1995; translated to Hebrew by Glicksohn, Leshem & Aharoni, 2006) was used as in Study 1. In this study, Cronbach's alpha was .82.

Thought suppression.

A version of the Food Thought Suppression Inventory (FTSI; Barnes, Fisak, & Tantleff-Dunn, 2009) was adapted for this study by back-to-back translation procedure (from English to Hebrew and back). For each of the references to thoughts about food, the authors substituted these with thoughts about sex and sexuality. The Thought Suppression Inventory is a 15-item unidimensional self-report measures that assesses the tendency to avoid sex -related thoughts (e.g., "There are images about sex that come to mind that I cannot erase") using a 5-point Likert scale (1 = Strongly disagree and 5 = Strongly agree). Higher scores indicate higher levels of thought suppression. In this study, Cronbach's alpha was .93.

Compulsive Sexual Behavior Disorder.

The Individual-based Compulsive Sexual Behavior Scale (I-CSB; Efrati & Mikulincer, 2018; originally developed in Hebrew) was developed to assess distinct aspects of CSBD, such as sexual fantasies, obsessive sexual thoughts, and spending a great deal of time watching pornography. The I-CSB is a 24-itme self-report measure assessing the following factors: Unwanted consequences (e.g., "I feel that my sexual fantasies hurt those around me"); lack of control (e.g., "I waste lots of time with my sexual fantasies"); negative affect (e.g., "I feel bad when I don't manage to control my sexual urges"); and affect regulation (e.g., "I turn to sexual fantasies as a way to cope with my problems"). Using a 7-point Likert scale, participants were asked to rate the degree to which each statement is descriptive of their feelings (1 = Not at all and 7 = Very much). Higher scores indicate higher levels of compulsive sexual behavior. This self-report measure was successfully employed in previous research on non-clinical populations of adults and adolescents (Efrati & Gola, 2019b) and in clinical populations of Sexaholics Anonymous Twelve-Step program patients (Efrati & Mikulincer, 2018; Efrati & Gola, 2018; Efrati, Gerber, & Tolmacz, 2019). We computed a total I-CSB score by averaging the 24 I-CSB items.

3.2. Procedure

This was the same as in Study 1.

3.3. Data analysis

Bivariate correlations among the variables were calculated using SPSS (version 25; IBM Corp, 2017).   A series of Shapiro-Wilk normality tests indicated that all of the variables were non-normally distributed at $p <.001$ level. Accordingly, all correlations were conducted using Spearman's Rho (see Table 1). Then, the pattern of relationships specified by our theoretical model (Figure 1) was tested using path analyses with the same parameters as in Study 1. Specifically, in the tested models, CSBD was the outcome variable, impulsiveness and thought suppression were the mediators, and the five MCQ-30 metacognitions (i.e., positive beliefs about worry, negative beliefs about thoughts concerning uncontrollability and danger, cognitive confidence, beliefs about the need to control thoughts, and cognitive self-consciousness) were the independent variables, whereas age, gender, and religious affiliation (low vs. high) were included as control variables on the two mediators and the outcome (Figure 1). In order to select the most plausible model, the full model was first tested. Subsequently, path coefficients not significant at the 5% level were removed step-by-step. For sake of brevity, Figure 3 shows the final model including significant path coefficient only.
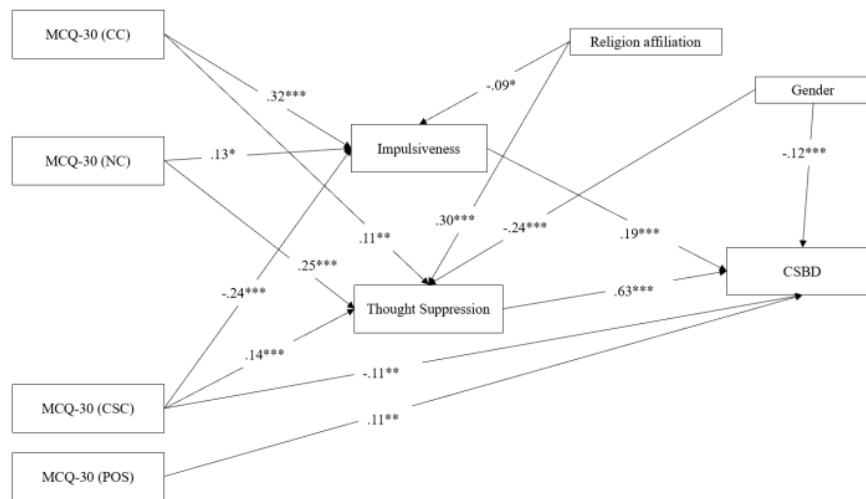

Figure 3. Results of the path analytical model with CSBD as outcome variable. Notes: *$p<0.05$, **$p<0.001$, ***$p<0.001$; N=453; Religious Affiliation = (1= Low, 2= High); Gender: 1= M, 2= F; MCQ-30 (POS) = Metacognitions Questionnaire-30 (Positive Beliefs about Worry); MCQ-30 (CC) = Metacognitions Questionnaire-30 (Cognitive Confidence); MCQ-30 (NC) = Metacognitions Questionnaire-30 (Beliefs about the Need to Control Thoughts); MCQ-30 (CSC) = Metacognitions Questionnaire-30 (Cognitive Self-Consciousness); BIS = Barret Impulsivity Scale; TSI = Thought Suppression Inventory; CSBD = Compulsive Sexual Behavior Disorder.

3.4. Results

3.4.1. Bivariate correlations

CSBD was strongly correlated with thought suppression (r_s = .68, $p < .001$) and had a weak correlation with impulsiveness (r_s = .29, $p < .001$), gender (r_s = -.28, $p < .001$), beliefs about the need for control thoughts (r_s = .28, $p < .001$), cognitive confidence (r_s = .24, $p < .001$), positive beliefs about worry (r_s = .15, $p < .001$), religiosity (r_s = .15, $p < .001$) and negative beliefs about thoughts concerning uncontrollability and danger (r_s = .14, $p < .001$).

3.4.2. Path analysis: Do thought suppression and impulsiveness mediate the association between metacognitions and CSBD?

The model was run on a sample of n = 453 adolescents (see Figure 3). Positive beliefs about worry were directly and positively associated with CSBD (though weakly), whereas cognitive self-consciousness was directly and negatively associated with CSBD. Moreover, cognitive confidence and beliefs about the need to control thoughts were positively

associated with impulsiveness and thought suppression, which, in turn were both positively associated with CSBD, with strongest association observed between thought suppression and CSBD. As regard the control variables, religious affiliation was positively associated with thought suppression and negatively associated with impulsiveness, whereas gender was negatively associated with both thought suppression and CSBD.

With regard to indirect relationships, results of the Sobel test supported the mediating role of impulsiveness between: (i) cognitive confidence and CSBD (β = .061, SE =.106, z = 4.066, p <.001); (ii) beliefs about the need to control thoughts and CSBD (β = .024, SE =.098, z = 2.023, p =.043); and cognitive self-consciousness and CSBD (β = -.045, SE =.094, z = -3.412, p =.001). Moreover, results supported the mediating role of thought suppression between: (i) cognitive confidence and CSBD (β = .070, SE =.187, z = 2.623, p =.009); (ii) beliefs about the need to control thoughts and CSBD (β = .015, SE =.118, z = 2.042, p = .041); and (iii) cognitive self-consciousness and CSBD (β = -.028, SE =.113, z = -3.446, p =.001).

With regard to model fit, the model accounted for 49% of the variance of CSBD, and 30% of the variance of thought suppression. Lower variance, yet a significant amount, was observed for impulsiveness (17%). Finally, the total amount of variance explained by the model (Total Coefficient of Determination, TCD = .46) indicated a good fit to the observed data. Indeed, this TCD corresponds to a correlation of r = .68, which can be considered a large effect size (Cohen, 1988).

3.5. Discussion

Study 2, to the best of our knowledge, is the first to examine the links between metacognitions and CSBD among adolescents, although research has found that early maladaptive schemas (which relate to distorted cognitions) are strong predictors of CSBD (Efrati, Shukron, & Epstein, 2019; 2020). Here, we found that positive beliefs about worry are directly and positively associated with CSBD. Positive beliefs about worry are key n the activation of various forms of coping such as thought suppression in the presence of distressing triggers (e.g., upsetting thoughts, emotions, sensations). Such activation often backfires and leads to an escalation of negative affect (Wells, 2000) and, here, to a greater severity of CSBD.

In addition, the path model showed that lower cognitive self-consciousness, which reflects less monitoring of thinking processes, is also directly linked with a greater severity of CSBD. Given that one core facet of CSBD is *lack of behavioral control* — constant uncontrolled engagement with sexual fantasies, urges, and behaviors with numerous unsuccessful efforts to significantly reduce repetitive sexual behavior — it makes sense that the tendency to monitor less thinking processes will facilitate lack of sexual-related behavioral control and so greater severity of CSBD.

Moreover, as in Study 1, similar mediation paths were revealed regarding impulsiveness. Specifically, we found that lack of confidence in one's mnemonic and attentional capabilities, lack of belief about the need to control thoughts, and lack of cognitive self-consciousness were associated with higher impulsiveness; higher impulsiveness, in turn, was linked with higher severity of CSBD. Unlike Study 1, the same metacognitions were also significantly mediated by thought suppression: lack of confidence in one's mnemonic and attentional capabilities, beliefs about the need to control thoughts, and lack of cognitive self-consciousness were associated with higher thought suppression; higher sex-related thought suppression was linked, in turn, with higher severity of CSBD. As suspected, given that CSBD incurs significant levels of negative affect, adolescents may try to suppress thoughts related to sex and sexuality and so, thought suppression may play a pivotal role in mediating the associations between metacognitions and CSBD.

Although Studies 1 and 2 supported our model regarding the role of metacognitions as well as impulsiveness (and to some extent thought suppression) in predicting behavioral addictions among adolescents, they explored addictive behaviors that are significantly more common among boys – IGD and CSBD (e.g., Lee, Han, Kim, & Renshaw, 2013; Sasmaz et al., 2014). We designed Study 3 to further test our model regarding behavioral

addictions by focusing on a behavioral addiction that is more prevalent among girls (Peris, de la Barrera, Schoeps, & Montoya-Castilla, 2020) – PSNU.

4. Study 3

We designed Study 3 to examine whether thought suppression and impulsiveness mediate the association between metacognitions (positive beliefs about worry, negative beliefs about thoughts concerning uncontrollability and danger, cognitive confidence, beliefs about the need to control thoughts, and cognitive self-consciousness) and PSNU, such that higher metacognitions would be associated with higher thought suppression and impulsiveness, which in turn would be linked with greater severity of PSNU.

4.1. Method
4.1.1. Participants

A convenience sample of 1003 adolescents (621 females; mean age = 16.04 years [SD = 1.21; range 14 to 18 years]) was recruited for this study and completed a battery of questionnaires online. Of the total sample, 31.4% classified themselves as secular, 24.7% classified themselves as traditional, 40.9% classified themselves as religious and 3.0% classified themselves as ultra-orthodox. As above, a dichotomous variable was created for religious affiliation by combining 'Secular' and 'Traditional' under the variable 'low religious affiliation' and 'Religious' and 'Ultra-Orthodox' as 'high religious affiliation'.

4.1.2. Self-report measures

Metacognitions.

The Metacognitions Questionnaire 30 (MCQ-30; Wells & Cartwright-Hatton, 2004) was used as in Study 1. In this study, Cronbach's alpha was .88.

Impulsiveness.

The Barratt Impulsiveness Scale-11 (BIS-11; Patton, Stanford, & Barratt, 1995; translated to Hebrew by Glicksohn, Leshem & Aharoni, 2006) was used as in Study 1. In this study, Cronbach's alpha was .82.

Thought suppression.

A version of the Food Thought Suppression Inventory (FTSI; Barnes, Fisak, & Tantleff-Dunn, 2009) was adapted for this study by back-to-back translation procedure (from English to Hebrew and back). For each of the references to thoughts about food, the authors substituted these with thoughts about social networks use. The Thought Suppression Inventory is a 15-item unidimensional self-report measures that assesses the tendency to avoid social networks use-related thoughts (e.g., "There are images about social networks use that come to mind that I cannot erase") using a 5-point Likert scale (1 = Strongly disagree and 4 = Strongly agree). Higher scores indicate higher levels of thought suppression. In this study, Cronbach's alpha was .94.

Problematic Social Networks Use.

PSNU was measured with the nine items of the Social Media Disorder Scale (Van den Eijnden, Lemmens, & Valkenburg, 2016) that was translated into Hebrew by a speaker proficient in both languages and then back translated by the first author. These nine items measured the same nine criteria that were used to measure Internet gaming disorder, but then applied to social networks use, i.e., Tolerance, Withdrawal, Displacement, Escape, Problems, Deception, Displacement, and Conflict. Participants were asked to complete the sentence "During the past year, have you…" using a 5-point scale ranging from 1 = Never to 5 = Very often (e.g., " …tried to spend less time on social networks, but failed). Higher scores indicate higher levels of problematic social networks use. In this study, Cronbach's alpha was .65.

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4.2. Procedure

This was the same as in Studies 1 and 2.

4.3. Data analysis

Bivariate correlations among the variables were calculated using SPSS (version 25; IBM Corp, 2017). A series of Shapiro-Wilk normality tests indicated that all of the variables were non-normally distributed at the $p <.001$ level. Accordingly, all correlations were conducted using Spearman's Rho (see Table 1). Then, the pattern of relationships specified by our theoretical model (Figure 1) was tested using path analyses with the same parameters as in Study 1. Specifically, in the tested models, PSNU was the outcome variable, impulsiveness and thought suppression were the mediators, and the five MCQ-30 metacognitions (i.e., positive beliefs about worry, negative beliefs about thoughts concerning uncontrollability and danger, cognitive confidence, beliefs about the need to control thoughts, and cognitive self-consciousness) were the independent variables, whereas age, gender, and religious affiliation (low vs. high) were included as control variables on the two mediators and the outcome (Figure 1). In order to select the most plausible model, the full model was first tested. Subsequently, path coefficients not significant at the 5% level were removed step-by-step. Figure 4 shows the final model including significant path coefficient only.
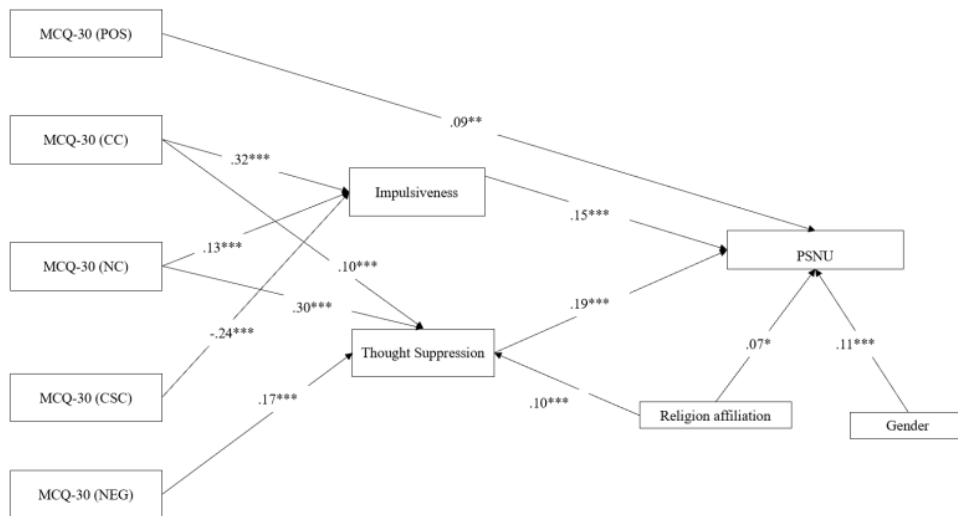

Figure 4. Results of the path analytical model with PSNU as outcome variable. Notes: *p<0.05, **p<0.001, ***p<0.001; N=1004; Religion Affiliation = (1= Low, 2= High); Gender: 1= M, 2= F; MCQ-30 (POS) = Metacognitions Questionnaire-30 (Positive Beliefs about Worry); MCQ-30 (NEG) = Metacognitions Questionnaire-30 (Negative Beliefs about Thoughts concerning Uncontrollability and Danger); MCQ-30 (CC) = Metacognitions Questionnaire-30 (Cognitive Confidence); MCQ-30 (NC) = Metacognitions Questionnaire-30 (Beliefs about the Need to Control Thoughts); MCQ-30 (CSC) = Metacognitions Questionnaire-30 (Cognitive Self-Consciousness); BIS = Barret Impulsivity Scale; TSI = Thought Suppression Inventory; PSNU = Problematic Social Networks Use.

4.4. Results

4.4.1. Bivariate correlations

PSNU was moderately correlated with thought suppression (r_s = .32, $p < .001$) and had a weak correlation with impulsiveness (r_s = .21, $p < .001$), gender (r_s = .13, $p < .001$), cognitive confidence (r_s = .15, $p < .001$), positive beliefs about worry (r_s = .15, $p < .001$), negative beliefs about thoughts concerning uncontrollability and danger (r_s = .14, $p < .001$),

beliefs about the need to control thoughts (r_s = .12, p < .001) and religiosity (r_s = .09, p < .001).

4.4.2. Path analysis: Do thought suppression and impulsiveness mediate the association between metacognitions and PSNU?

The model was run on a final sample of n = 1000 adolescents (as 3 participants of the total sample of N = 1003 did not complete one or more scale). Positive beliefs about worry were directly and positively associated with PSNU (though weakly). Cognitive confidence and beliefs about the need to control thoughts were positively associated with impulsiveness and thought suppression, with cognitive confidence showing the strongest association with impulsiveness and beliefs about the need to control thoughts showing the strongest association with thought suppression. Negative beliefs about thoughts concerning danger and uncontrollability were positively associated to thought suppression only, whereas cognitive self-consciousness was negatively associated to impulsiveness only. In turn, impulsiveness and thought suppression were both positively associated to PSNU (Figure 4). As regard the control variables, religious affiliation was positively associated with thought suppression and problematic social networks use, whereas gender had a positive association with PSNU.

With regard to indirect relationships, results of the Sobel test supported the mediating role of impulsiveness between: (i) cognitive confidence and PSNU (β = .048, SE =.035, z = 4.615, p <.001); (ii) beliefs about the need to control thoughts and PSNU (β = .019, SE =.027, z = 2.845, p =.004); and cognitive self-consciousness and PSNU (β = -.035, SE =.031, z = -4.069, p < .001). Moreover, results supported the mediating role of thought suppression between: (i) negative beliefs about thoughts concerning uncontrollability and danger and PSNU (β = .032, SE =.027, z = 3.810, p <.001); (ii) cognitive confidence and PSNU (β = .019, SE =.023, z = 2.776, p = .005); and (iii) beliefs about the need to control thoughts and PSNU (β = .014, SE =.005, z = 2.729, p =.006).

With regard to model fit, the model accounted for 10% of the variance of PSNU, 22% of the variance of thought suppression and 16% of the variance of impulsiveness. Finally, the total amount of variance explained by the model (Total Coefficient of Determination, TCD = .36) indicated a good fit to the observed data. Indeed, this TCD corresponds to a correlation of r = .60, which can be considered a large effect size (Cohen, 1988).

5. Discussion

Study 3 was designed to examine whether thought suppression and impulsiveness mediate the associations between metacognitions and PSNU. As in Study 2, we found that positive beliefs about worry were directly and positively associated with PSNU, which perfectly fits with the backfire effect that was found to be related to the process (Wells, 2000).

Moreover, as in Studies 1 and 2, similar mediation paths were revealed regarding impulsiveness. Specifically, we found that lack of confidence in one's mnemonic and attentional capabilities, beliefs about the need to control thoughts, and lack of cognitive self-consciousness were associated with higher impulsiveness; higher impulsiveness, in turn, was linked with higher severity of PSNU. Study 3 also indicated that thought suppression mediated the associations between metacognitions and PSNU, although only two out of the three mediating paths replicated those of Study 2. As in Study 2, we found that lack of confidence in one's mnemonic and attentional capabilities, and beliefs about the need to control thoughts were associated with higher thought suppression; higher social-networks-use-related thought suppression was linked, in turn, with higher severity of PSNU. Unlike Study 2, we found that negative beliefs about thoughts concerning uncontrollability and danger, and not lack of cognitive self-consciousness were linked to social-networks-use-related thought suppression. This discrepancy may stem from two factors: (i) In each study we used a topic-specific thought suppression measurement that might alter the pattern of associations; and (ii) In Study 2, we examined CSBD, which is more prevalent among boys and in Study 3 we examined PSNU, which is more prevalent among girls.

Although no gender differences were reliably recorded in metacognitions (e.g., Kolić-Vehovec, Bajšanski, & Zubković, 2010; Wells & Cartwright-Hatton, 2004), research has indicated differences in thought suppression between genders such that women tend to use it more often than men (e.g., Robichaud, Dugas, & Conway, 2003). These differences may account for the differences in results of Studies 2 and 3.

5.1. General Summary Discussion

The goal of the current three-study research was to investigate the association between metacognitions, thought suppression, impulsiveness, and three behavioral addictions among adolescents (IGD, CSBD and PSNU). Overall, the findings underscore the relative importance of different metacognitions in predicting behavioral addictions and the mediating role of impulsiveness, and partly thought suppression, between metacognitions and behavioral addictions.

The current research has revealed consistent and reliable mediation paths involving impulsiveness. Specifically, we found that lack of cognitive confidence, beliefs about the need to control thoughts, and lack of cognitive self-consciousness were all linked with higher impulsiveness and via high impulsiveness with all the behavioral addictions we examined.

The current research also revealed equivocal results regarding domain-specific thought suppression. Whereas metacognitions were not linked to thought suppression in IGD, lack of confidence in one's thoughts or judgments, and beliefs about the need to control thoughts. were linked to thought suppression in CSBD and PSNU.

Two metacognitions therefore clearly emerge as 'transdiagnostic' factors in predicting, broadly, impulsiveness and thought suppression that are at the core of (most) behavioral addictions in adolescents: lack of cognitive confidence and beliefs about the need to control thoughts. Why would this be the case? Cognitive confidence refers to a subjective belief about the validity of one's thoughts or judgments. The degree of confidence can vary from extreme certainty to extreme doubt in the validity of memories, decisions, and judgement. Cognitive confidence is important because it affects whether people translate their individual thoughts into more general judgments, and whether these judgments in turn are influential in guiding behavior. Here, we found that lack of cognitive confidence is tightly linked with both impulsiveness and thought suppression, which might reflect an inhibition in the translation of thoughts into concrete judgements and so more impulsive and less guided behaviors (Spada et al., 2015). Beliefs about the need to control thoughts are likely to activate strategies (such as desire thinking, rumination and worry as well as thought suppression) which may make, paradoxically, thoughts become more salient in consciousness as well as increase in affective responses that are linked to experiencing such thoughts (e.g., a sexual or gaming urge). This, in turn, could bring to an escalation in the sense of deprivation for a given target (e.g., pornography, gaming., etc.) and greater impulsive behavior (Spada et al., 2015).

5.2. Therapeutic implications of the current research

There are numerous clinical and health implications that arise from the current research. First and foremost, the current research might help to better tailor psychotherapeutic interventions for adolescents with behavioral addictions. Over the last twenty-five years the Self-Regulatory Executive Function (S-REF) model has offered novel insights into the role of metacognition in psychopathology (Wells & Matthews, 1994, 1996; Wells, 2000), and specifically to the development of a novel form of psychological therapy, Metacognitive Therapy (MCT; Wells, 2009). MCT was successfully employed as an intervention in various addictions such as alcohol use (Caselli, Martino, Spada, & Wells, 2018) and substance abuse (Inchausti, Ortuño-Sierra, García-Poveda, & Ballesteros-Prados, 2017). From the metacognitive standpoint, psychological disturbances are maintained by the activation of the Cognitive-Attentional Syndrome (CAS). The CAS encompasses repetitive negative thinking styles (rumination and worry) as well as thought suppression and maladaptive self-monitoring. The activation of the CAS brings an increase of

attentional focus toward a specific stimulus and a feedback loop that fail to regulate the related thoughts and behaviors. The activation, perseveration and escalation of the CAS is linked to the presence of unhelpful metacognitions. Using MCT techniques such as detached mindfulness might prove to be effective in reducing negative meta-appraisal of addiction-related thoughts (internet-gaming-related, sexual-related, and/or social-networks-related) and by doing so potentially reduce impulsive decision making and actions and thus the severity of the behavioral addictions.

5.3. Limitations

Although our main hypotheses were supported, the research has several limitations. First, Studies 1 to 3 are correlational in nature and so precludes conclusions regarding causal processes linking metacognitions to addictive behaviors via impulsiveness and thought suppression. Longitudinal studies are necessary to determine the directionality of the associations among adolescents. Secondly, the research population was comprised Israeli, Jewish adolescents. Future studies might examine the generability of our model using more diverse populations.

6. Concluding remarks

This is the first study to show, in an adolescent population, the role played by metacognitions in predicting common behavioral addictions (IGD, CSBD and PSNU) through both thought suppression and impulsiveness pathways. These findings broadly support a metacognitive a conceptualization of psychopathology as applied to behavioural addictions and showcase the importance of meta-belief systems and control strategies in younger populations.

Conflicts of Interest: the authors have no conflict of interest to declare.

Ethics approval: Research ethics approval was obtained to conduct the study from the Beit-Berl's Institutional Review Board (IRB) committee.

Informed consent: Written informed consent was obtained from all participants.

Authors' contribution: Yaniv Efrati conducted the study and wrote, with Marcantonio Spada, the introduction section of the article. Claudia Marino and Daniel C. Kolubinski analyzed the results and wrote the Methods and Results section of the article. All authors contributed to the Discussion section of the article and edited the final draft of the article.

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