J Gambl Stud (2016) 32:93–106
DOI 10.1007/s10899-014-9519-5

ORIGINAL PAPER

The Role of Metacognition in Pathological Gambling: A Mediation Model

Giovanni Mansueto · Michele Pennelli · Valeria De Palo · Lucia Monacis · Maria Sinatra · Maria Fara De Caro

Published online: 20 January 2015

Abstract Pathological gambling involves multitudinous costs related to financial, legal, and public health care aspects, as well as to specific psychological disorders. Despite the overall evidence suggesting that comorbid disorders represent a risk factor for pathological gambling, there is scant evidence on the appropriate treatments for gamblers with such disorders. In this context, metacognitive therapy is an interesting approach because it considers psychological disorders as a result of the activation of perseverative cognitive processes and attentional strategies in response to inner events. Several studies report that metacognition is associated with different psychological problems. This study investigated the relationship among comorbid disorders, metacognition, and pathological gambling. 69 pathological gamblers at the first hospital admission and 58 controls drawn from general population (matched for age, gender, education) completed a battery of self report instruments: Symptom Checklist-90-R, Metacognition Questionnaire 30, South Oaks Gambling Scale. Compared to controls, pathological gamblers showed higher level of comorbid symptomatology and metacognition. Correlation analyses showed that: comorbid symptomatology and metacognition were positively and significantly correlated with pathological gambling; metacognition was positively and significantly associated with comorbid symptomatology. Mediation analysis indicated that dysfunctional metacognitive

G. Mansueto · M. Pennelli · M. F. De Caro
Department of Basic Medical Sciences, Neurosciences and Sense Organs, University of Bari, Piazza G. Cesare No. 11, 70121 Bari, Italy

V. De Palo
Department of Philosophy, Education, and Psychology, University of Verona, Lungadige Porta Vittoria No. 17, 37129 Verona, Italy

L. Monacis
Department of Humanistic Studies, University of Foggia, Via Arpi No. 176, 71100 Foggia, Italy

M. Sinatra (✉)
Department of Educational Sciences, Psychology, Communication, University of Bari, Palazzo Ateneo, Piazza Umberto I, 70121 Bari, Italy
e-mail: maria.sinatra@uniba.it

strategies could have an indirect effect on pathological gambling mediated by concurrent psychological disorders. These findings provide some implications for gambling treatment programs: pathological gamblers should be screened for psychiatric disorders, and metacognitive therapy could be considered a correct treatment of pathological gamblers. Metacognitive therapy might lead to the reduction of the pathological gambling by the diminishing of the concurrent psychological disorders.

Keywords Gambling · Comorbid disorders · Metacognition · Metacognitive therapy

Introduction

Pathological gambling (PG) is a progressive and chronic disorder, categorized by the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) as a disorder of impulse control (APA 1994). Epidemiological studies estimate that the prevalence of PG is between 1.1 and 5.3 % among the adult population (Castrén et al. 2013; Lorains et al. 2011; Raylu and Oei 2002), with Italian rates estimated at 2.3 % for youths and 2.2 % for adults (Bastiani et al. 2013). The social and economic costs of PG are multitudinous, and PG may be associated with a negative impact on the physical and mental health of gamblers and their family members, with financial and legal problems (such as bankruptcy, loans, criminal acts to gain money), as well as with interpersonal problems between gamblers and their significant others (such as domestic violence, relationship breakdown, neglect of family) (Raylu and Oei 2002).

It is broadly known that many psychological disorders are likely to co-occur with gambling problems (Lorains et al. 2011). Recently, several studies have reported that the prevalence rates of PG among general psychiatry patients also tend to be high 6.7–12 % (Johansson et al. 2009; Raylu and Oei 2002); more specifically, gambling problems are associated with high level of comorbid disorders including mood disorder, depression, anxiety disorders, bipolar disorder, personality disorders, alcohol, substance and nicotine use (Petry 2005).

Despite the overall evidence suggesting that comorbid disorders represent a relevant risk factor for pathological gambling, and are associated with severe consequences (Castrén et al. 2013; Johansson et al. 2009), there is scant evidence on the appropriate treatments for gamblers with comorbid disorders. The metacognitive therapy (MCT) developed by Wells (2009), for example, could be considered a fruitful approach which looks at psychological disorders as a result of the activation of perseverative cognitive processes and attentional strategies in response to inner events (emotions, memories, thoughts and physiological states). These perseverative cognitive processes and attentional strategies are considered as a component of a cognitive attentional syndrome (Wells 2000). Metacognition can be defined as a "stable knowledge or beliefs about own cognitive system, and knowledge about factors that impact the functioning of the system; the regulation and awareness of the current state of cognition, and appraisal of the significance of thought and memories" (Wells 1995, p. 302). Moreover, in Wells' model (2009), metacognition was divided into two sets of beliefs: negative beliefs regarding the significance, controllability and danger of specific types of inner events, and positive beliefs about coping strategies that impact on inner events. Although a growing body of evidence has provided that metacognition is associated with a large range of psychological problems

including depression, anxiety disorder, obsessive–compulsive symptoms, nicotine dependence, problem drinking, pathological worry, post-traumatic stress disorders, predisposition to auditory hallucinations (Morrison et al. 2000; Papageorgiou and Wells 2003; Roussis and Wells 2006; Spada et al. 2007, 2009; Wells and Papageorgiou 1998; Wells 2005), few studies examined gambling using a metacognitive perspective (Brevers et al. 2014; Caselli and Spada 2010; Lindberg et al. 2011). Lindberg et al. 2011 reported that metacognition independently predicted problem gambling when controlling for negative emotion. Specifically, negative beliefs about thoughts concerning uncontrollability, danger, and beliefs about the need to control thoughts seem to predict gambling behaviours independently from anxiety and depression.

Given these results, it could be supposed that metacognition may also have indirect effects on PG by the mediator factor of the comorbid disorders. To our knowledge, no studies assessed the role of the concurrent psychological disorders in the relationship between metacognition and pathological gambling. Thus, the aim of the present study was to investigate whether and to what extend the presence of concurrent psychological disorders could account for the association between metacognition and pathological gambling. The hypotheses to be tested were: (1) pathological gamblers compared to general population could have high levels of comorbid disorders and dysfunctional metacognitive strategies; (2) comorbid psychopathological symptoms could be positively correlated with gambling; (3) metacognition could be positively correlated with both comorbid psychopathological symptoms and gambling; (5) comorbid psychopathological symptoms could be a mediator factor between metacognition and pathological gambling.

Method

Participants

In the current study 69 pathological gamblers, recruited from the Department of Pathological Addictions of Local Health Board (AUSL, Bari, Italy). Matched for age, gender, and education with a pathological sub-sample, a group of 58 participants, was enrolled. All patients were at the first hospital admission and reported a total score $\geq$5 on the South Oaks Gambling Screen (SOGS) (Lesieur and Blume 1987) indicating the presence of a gambling problem. Exclusion criteria were current or past neurological disorders, as well as under 18 aged subjects for all participants. The study protocol was approved by the local ethics committee with approval number 24012013 and all participants provided written informed consent.

Instruments

A questionnaire composed by a socio-anagraphic section and three scales was administered. The problem gambling was measured utilizing the Italian version of the SOGS (Capitanucci and Carlevaro 2004; Lesieur and Blume 1987). It is a 20-item self-report instrument of gambling. A total score of 0 indicates no problem with gambling, 1–4 indicates at-risk gambling behaviour or possible pathological gambling, and a score of 5 or more indicates probable pathological gambling (Stinchfield 2002). The SOGS has been shown to meet the criterion of validity generalization (Gambino and Lesieur 2006). This version showed a good internal consistency (Cronbach's alpha = .93) in the current study.

The psychopathology was assessed by the Symptom Checklist-90-R (SCL-90-R; Derogatis 1977, 1994), as the authors of the Italian version suggested the use of the original instrument in the empirical studies (Preti et al. 2012; Prunas et al. 2012). Respondents rated 90 items to measure the extent to which they had experienced the listed symptoms in the last 10 days. The items are divided into nine subscales: Somatization, Obsessive–Compulsive, Interpersonal Sensitivity, Depression, Anxiety, Hostility, Phobic Anxiety, Paranoid Ideation, and Psychoticism. Higher scores on the SCL-90-R indicated a greater psychological distress. The SCL-90-R also has three global indexes: the Global Severity Index (GSI) measures the extent or depth of the individual's psychiatric disturbance; the Positive Symptom Total counts the total number of questions rated above 1 point; the Positive Symptom Distress Index represents the intensity of symptoms. Internal consistency and test–retest reliability coefficients are acceptable for the nine symptom dimensions, and factor analytic studies have generally confirmed the intended structure of the inventory (Derogatis 1977). In our study, the SCL90-R showed a good internal consistency (Cronbach's alpha = .97).

The metacognition strategies were evaluated by the Italian version of the Metacognition Questionnaire 30 (MCQ-30) (Wells and Cartwright-Hatton 2004; Wells 2012). It is a 30-item self-report Likert-based instrument that assesses five factors regarding metacognition: (1) Positive beliefs about worry (e.g. "worrying helps me cope"), which measure the extent to which a person believes that perseverative thinking is useful; (2) Negative beliefs about thoughts concerning uncontrollability and danger (e.g. "when I start worrying I cannot stop") assessing the extent to which a person believes that perseverative thinking is uncontrollable and dangerous; (3) Cognitive confidence (e.g. "my memory can mislead me at times"), which assesses confidence in attention and memory; (4) Beliefs about the need to control thoughts (e.g. "not being able to control my thoughts is a sign of weakness") assessing the extent to which a person believes that certain types of thoughts need to be suppressed; (5) Cognitive self-consciousness (e.g. "I pay close attention to the way my mind works"), which measures the tendency to monitor one's own thoughts and focuses attention inwards. Higher scores indicate greater levels of maladaption in metacognition. The MCQ-30 possesses good psychometric properties (Spada et al. 2008; Wells and Cartwright-Hatton 2004). In the current study, this version demonstrated a good internal consistency (Cronbach's alpha = .92).

Statistics

Chi square and Fisher's test were used for the categorical variables (i.e., gender) and Student's *t* test for the continuous variables (i.e., age, educational level, problem gambling, psychopathology and metacognition) in order to evaluate the differences between patients and controls. Path models were estimated to examine the mediating role of the comorbid psychopathological symptoms (SCL-90) between metacognition (MCQ-30) and pathological gambling (SOGS) within a pathological gambler sample. In accordance with Baron and Kenny (1986), a correlation analysis was used before evaluating the mediation effects to ensure that the independent, dependent, and mediator variables correlated one to each other. The mediational model was tested in according to Baron and Kenny's criteria (1986), thus fully or partially mediating relationship occurs when the relationship between the predictor and criterion is non-significant or still significant, respectively, after controlling for the effect of the mediator. Meditational analyses were chosen on the basis of the associations between metacognition and psychological disorders (Wells 2009, 2012), and between metacognition and gambling (Lindberg et al. 2011). The significance of the

indirect effect was tested utilizing a bootstrapping procedure, recommended in assessing the mediation models for small size samples (MacKinnon et al. 2002; Preacher and Hayes 2004). The advantage of the bootstrapping procedure not only does include no assumption of normality of the sampling distribution of the indirect effects, but it also allows a high power while maintaining adequate control over Type I error rate. The interpretation of the mediation analysis is placed in the direction and size of indirect effects. An indirect effect was considered significant if its 95 % Bias Corrected and Accelerated (BCa) bootstrap CIs excluded zero. In this study, the mediation model was tested through the SPSS macros for bootstrapping as provided by Preacher and Hayes (2004). The mediating effect of the GSI as well as the indirect, direct, and total effects of the metacognition dimensions on pathological gambling were calculated with 5.000 bootstrap samples.

Results

Kolmogorov–Smirnov tests ($p < .01$) revealed that all scores were normally distributed. Table 1 shows the descriptive statistics for all questionnaire variables. Pathological gamblers and controls resulted matched for gender (male 88.4 vs. 89.7 %, $\chi^2 = .05$, $df = 1$, $p = .82$), mean age (42.43 ± 12.11 vs. 41.65 ± 12.32 years, $t = -35.8$, $df = 125$, $p = .72$) and education level (years of school: 12.33 ± 3.52 vs. 12.34 ± 3.47, t = .018, $df = 125$, $p = .98$). Cases and controls did not differ in marital status (singles 42 vs. 39.7 %, married 42 vs. 55.2 %, divorced 15.9 vs. 5.2 %; $\chi^2 = 4.49$, $df = 2$, $p = .11$).

Comparison Between Pathological Gamblers and Controls

The SOGS clearly distinguished pathological gamblers and controls, since the formers showed a significantly higher probable pathological gambling score. Compared to controls, the pathological respondents showed a higher score both in the SCL-90-R, with exception of the somatization and phobic anxiety dimensions, and in the MCQ-30, with exception of the positive beliefs and cognitive confidence dimensions (Table 1).

Correlation Analyses of the Pathological Gambling Sample

Pearson's correlation analyses revealed that both the SCL-90-R and the MCQ-30, with exception of the cognitive confidence dimensions, were positively and significantly associated with the Total Gambling Scores (SOGS). All the MCQ-30 scales were positively and significantly associated with the SCL-90-R scales (Table 2).

Mediation Analysis in the Pathological Gambling Sample

Five path models were estimated to examine the mediating role of the GSI between each MCQ-30 dimension and the Total Gambling Score (SOGS). As no correlations between cognitive confidence and Total Gambling Score (SOGS) were found, the mediation effect of the GSI was not tested.

The first path model was conducted to test the mediating role of the GSI between negative beliefs (predictor) and Total Gambling Score (criterion): regression analysis revealed that the path direct coefficient was significant ($\beta = .22$, $SE = .10$, $t = 2.28$, $p = .025$); the second regression analysis showed that negative beliefs significantly

Table 1 Descriptive statistic and mean difference between pathological gamblers and controls

	Total sample (n = 127)		Pathological gamblers (n = 69)		Controls (n = 58)		$t_{(df)}$	p
	M	SD	M	SD	M	SD		
SOGS Total Score	6.10	6.19	11.08	3.95	.17	.67	$-20.77_{(125)}$	<.001
Somatization	49.07	14.56	51.03	17.72	46.73	9.18	$-1.66_{(125)}$	.098
Obsessive–compulsive	52.43	16.45	56.35	19.20	47.77	10.85	$-3.01_{(125)}$	.002
Interpersonal sensitivity	51.70	15.70	55.10	18.21	47.66	10.91	$-2.72_{(125)}$	.005
Depression	55.54	19.55	62.82	22.65	46.87	9.63	$-4.99_{(125)}$	<.001
Anxiety	54.62	20.43	61.68	23.34	46.24	11.86	$-4.56_{(125)}$	<.001
Hostility	51.95	12.19	55.86	13.15	47.29	9.05	$-4.19_{(125)}$	<.001
Phobic anxiety	52.85	16.96	55.11	18.65	50.15	14.40	$-1.65_{(125)}$	.101
Paranoid ideation	51.61	14.81	54.13	16.93	48.62	11.22	$-2.11_{(125)}$	.031
Psychoticism	56.71	24.14	62.61	28.35	49.68	15.39	$-3.10_{(125)}$	.001
General Symptomatic Index	53.94	21.13	60.40	24.46	46.24	12.73	$-3.97_{(125)}$	<.001
Positive Symptom Distress Index	.21	.21	.28	.21	.12	.16	$-4.65_{(125)}$	<.001
Positive Symptom Total	1.60	.56	1.84	.61	1.32	.34	$-5.75_{(125)}$	<.001
Metacognition Total score	48.97	15.14	52.47	17.29	44.81	10.83	$-2.92_{(125)}$	.004
Positive beliefs	7.95	3.31	8.26	3.92	7.58	2.37	$-1.14_{(125)}$	.236
Negative beliefs	10.80	4.25	11.85	4.64	9.55	3.35	$-3.14_{(125)}$	.002
Cognitive confidence	8.02	2.89	8.20	3.41	7.81	2.11	$-.761_{(125)}$	.430
Beliefs about the need to control thoughts	10	4.14	11.01	4.82	8.81	2.73	$-3.06_{(125)}$	.002
Cognitive self-consciousness	12.19	4.54	13.15	4.81	11.05	3.94	$-2.66_{(125)}$	.009

predicted GSI ($\beta = 3.56$, $SE = .47$, $t = 7.54$, $p < .001$); the third regression analysis demonstrated that GSI ($\beta = .06$, $SE = .025$, $t = 2.64$, $p = .010$) fully mediated the relationships between negative beliefs ($\beta = -.004$, $SE = .13$, $t = -.03$, $p = .97$) and Total Gambling Score. The indirect effect of negative beliefs through GSI was significant, and the estimate was .23 with a 95 % BCa bootstrap CI of .51–.42.

The second path model was conducted to test the mediating role of GSI between positive beliefs (predictor) and Total Gambling Score (criterion): the first regression analysis revealed that the path direct coefficient was significant ($\beta = .32$, $SE = .12$, $t = 2.75$, $p = .007$); the second regression analysis reported that positive beliefs significantly predicted GSI ($\beta = 2.28$, $SE = .71$, $t = 3.21$ $p = .002$); the third regression analysis demonstrated that GSI ($\beta = .05$, $SE = .02$, $t = 2.77$, $p = .007$) fully mediated the relationships between positive beliefs and Total Gambling Score ($\beta = .19$, $SE = .12$, $t = 1.67$, $p = .099$). The indirect effect of positive beliefs through GSI was significant, and the estimate was .12 with a 95 % BCa bootstrap CI of .25–.33.

The third path model was conducted to test the mediating role of GSI between beliefs about the need to control (predictor) and Total Gambling Score (criterion): the regression analysis revealed that the path direct coefficient was significant ($\beta = .22$, $SE = .09$,

Table 2 Two-tailed pearson's correlations of study variables of the pathological gambling sample ($n = 69$)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. SOGS Total Score	–															
2. Somatization	.290*	–														
3. Obsessive–compulsive	.379**	.744**	–													
4. Interpersonal sensitivity	.401**	.660**	.814**	–												
5. Depression	.293*	.707**	.907**	.823**	–											
6. Anxiety	.455**	.774**	.828**	.772**	.795**	–										
7. Hostility	.383**	.637**	.691**	.713**	.713**	.697**	–									
8. Phobic anxiety	.281*	.584**	.667**	.712**	.601**	.655**	.608**	–								
9. Paranoid ideation	.321**	.637**	.793**	.778**	.727**	.734**	.651**	.642**	–							
10. Psychoticism	.472**	.795**	.769**	.864**	.763**	.811**	.753**	.723**	.764**	–						
11. GSI	.401**	.849**	.929**	.900**	.921**	.908**	.792**	.749**	.843**	.915**	–					
12. MCQ-30-pos	.318**	.342**	.289*	.395**	.305*	.303*	.393**	.242*	.264*	.417**	.366**	–				
13. MCQ-30-neg	.269*	.538**	.634**	.655**	.679**	.650**	.539**	.494**	.459**	.593**	.678**	.473**	–			
14. MCQ-30-cc	.042	.421**	.425**	.487**	.449**	.416**	.293*	.464**	.382**	.429**	.485**	.555**	.509**	–		
15. MCQ-30-nc	.272*	.382**	.538**	.474**	.547**	.445**	.434**	.362**	.399**	.474**	.522**	.560**	.673**	.471**	–	
16. MCQ-30-sc	.315**	.367**	.458**	.375**	.418**	.401**	.254*	.247*	.278*	.431**	.425**	.485**	.566**	.381**	.711**	–
17. MCQ-30-tot	.316**	.514**	.597**	.598**	.609**	.561**	.484**	.449**	.447**	.591**	.624**	.754**	.821**	.697**	.877**	.813**

MCQ-30-pos refers to positive beliefs, MCQ-30-neg refers to negative beliefs, MCQ-30-cc refers to cognitive confidence, MCQ-30-nc refers to beliefs about the need to control thoughts, MCQ-30-sc refers to cognitive self-consciousness, MCQ-30-tot refers to Metacognition Total Score, GSI refers to General Symptomatic Index

* $p < .05$; ** $p < .005$; *** $p < .001$

$t = 2.31$, $p = .023$); the second regression analysis showed that beliefs about the need to control significantly predicted GSI ($\beta = 2.64$, $SE = .52$, $t = 5.01$, $p < .001$); the third regression analysis demonstrated that after controlling for GSI, ($\beta = .05.$, $SE = .02$, $t = 2.70$, $p = .008$) the effect of beliefs about the need to control on Total Gambling Score was not significant ($\beta = .07$, $SE = .11$, $t = .65$, $p = .515$). The indirect effect of beliefs about the need to control through GSI was significant, and the estimate was .15 with a 95 % BCa bootstrap CI of .03–.32.

The fourth path model was conducted to test the mediating role of GSI between cognitive self-consciousness (predictor) and total Gambling Score (criterion): the regression analysis revealed that the path direct coefficient was significant ($\beta = .25$, $SE = .09$, $t = 2.71$, $p = .008$); the second regression analysis showed that cognitive self-consciousness significantly predicted GSI ($\beta = 2.16$, $SE = .56$, $t = 3.84$, $p = .0003$); the third regression analysis demonstrated that GSI ($\beta = .05$, $SE = .02$, $t = 2.66$, $p = .009$) fully mediated the relationships between cognitive self-consciousness and Total Gambling Score ($\beta = .14$, $SE = .10$, $t = 1.43$, $p = 1.55$). The indirect effect of cognitive self-consciousness through GSI was significant, and the estimate was .11 with a 95 % BCa bootstrap CI of .02–.24.

Furthermore, the last path model demonstrated that GSI fully mediated the relationships between Metacognition Total Score and Total Gambling Score (Fig. 1). The indirect effect of Metacognition Total Score through GSI was significant, and the estimate was .05 with a 95 % BCa bootstrap CI of .002–.10.

In addition, path models were estimated to examine the mediating role of each sub scale of SCL-90 (Somatization, Obsessive–Compulsive, Interpersonal Sensitivity, Depression, Anxiety, Hostility, Phobic Anxiety, Paranoid Ideation, and Psychoticism) between each MCQ dimension and the Total Gambling Score (SOGS) (Table 3).

The relationship between negative beliefs and Total Gambling Score was fully mediated by subscale Obsessive–Compulsive (indirect effect = .18; 95 % BCa bootstrap CI .03–.35), subscale Interpersonal Sensitivity (indirect effect = .21; 95 % BCa bootstrap CI .06–.38), subscale Anxiety (indirect effect = .19; 95 % BCa bootstrap CI .12–.43), subscale

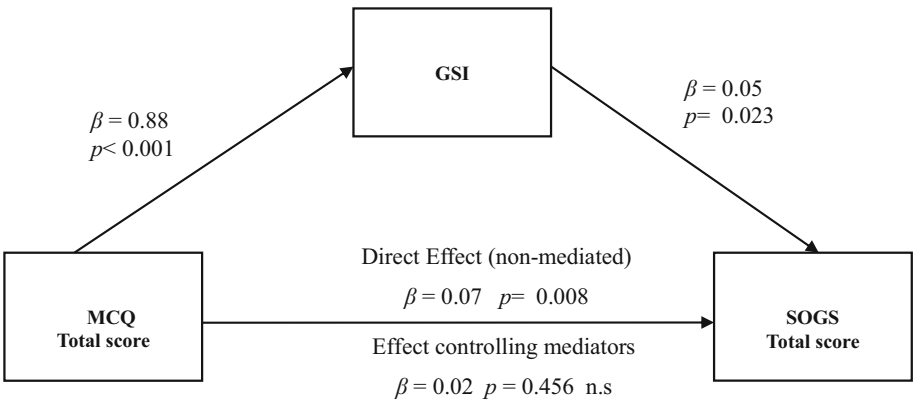

Fig. 1 Mediating effect of General Index of Psychopathology (GSI) in the relationship between metacognition (MCQ Total Score) and pathological gambling (SOGS Total Score) in the pathological gambling sample

Table 3 Mediation analysis in the pathological gambling sample: a mediator role of the comorbid psychopathological symptoms between metacognition and pathological gambling

Predictors				
Mediators	Negative beliefs	Positive beliefs	Beliefs about the need to control thoughts	Cognitive self-consciousness
Obsessive–compulsive				
Step 1	$\beta = .22$, SE = .10, t = 2.28, $p = .02$	$\beta = .32$, SE = .12, t = 2.74, $p = .007$	$\beta = .22$, SE = .09, t = 2.31, $p = .02$	$\beta = .25$, SE = .09, t = 2.71, $p = .008$
Step 2	$\beta = 2.61$, SE = .39, t = 6.70, $p < .001$	$\beta = 1.41$, SE = .57, t = 2.47, $p = .02$	$\beta = 2.13$, SE = .41, t = 5.22, $p < .001$	$\beta = 1.83$, SE = .43, t = 4.21, $p = .0001$
Step 3	$\beta = .07$, SE = .03, t = 2.36, $p = .02$	$\beta = .06$, SE = .02, t = 2.70, $p = .01$	$\beta = .06$, SE = .03, t = 2.42, $p = .02$	$\beta = .06$, SE = .03, t = 2.34, $p = 02$
Step 4	$\beta = .04$, SE = .12, t = .33, $p = .74$	$\beta = .22$, SE = .11, t = 1.97, $p = .053$	$\beta = .08$, SE = .11, t = .72, $p = .47$	$\beta = .15$, SE = .10, t = 1.42, $p = .16$
Interpersonal sensitivity				
Step 1	$\beta = .22$, SE = .10, t = 2.28, $p = .02$	$\beta = .32$, SE = .12, t = 2.74, $p = .007$	$\beta = .22$, SE = .09, t = 2.31, $p = .02$	$\beta = .25$, SE = .09, t = 2.71, $p = .008$
Step 2	$\beta = 2.56$, SE = .36, t = 7.10, $p < .001$	$\beta = 1.83$, SE = .52, t = 3.51, $p = .008$	$B = 1.78$, SE = .41, t = 4.40, $p = <.001$	$\beta = 1.42$, SE = .42, t = 3.31, $p = .01$
Step 3	$\beta = .08$, SE = .03, t = 2.63, $p = .01$	$\beta = .07$, SE = .03, t = 2.70, $p = .01$	$B = .08$, SE = .03, t = 2.74, $p = .01$	$\beta = .07$, SE = .02, t = 2.75, $p = .01$
Step 4	$\beta = .009$, SE = .13, t = .07, $p = .94$	$\beta = .19$, SE = .12, t = 1.57, $p = .12$	$B = .08$ SE = .10, t = .83, $p = .41$	$\beta = .16$, SE = .09, t = 1.61, $p = .11$
Anxiety				
Step 1	$\beta = .22$, SE = .10, t = 2.28, $p = .02$	$\beta = .32$, SE = .12, t = 2.74, $p = .007$	$\beta = .22$, SE = .09, t = 2.31, $p = .02$	$\beta = .25$, SE = .09, t = 2.71, $p = .008$
Step 2	$\beta = 3.26$, SE = .46, t = 7.01, $p < .001$	$\beta = 1.80$, SE = .69, t = 2.60, $p = .01$	$\beta = 2.15$, SE = .52, t = 4.07, $p = .0001$	$\beta = 1.94$, SE = .54, t = 3.58, $p = .001$
Step 3	$\beta = .08$, SE = .02, t = 3.36, $p = .001$	$\beta = .06$, SE = .02, t = 3.51, $p = .001$	$\beta = .07$, SE = .02, t = 3.41, $p = .001$	$\beta = .06$, SE = .02, t = 3.31, $p = .001$

Table 3 continued

Predictors				
Mediators	Negative beliefs	Positive beliefs	Beliefs about the need to control thoughts	Cognitive self-consciousness
Step 4	$B = -.03$, SE = .12, t = −.32, $p = .74$	$\beta = .20$, SE = .11, t = 1.76, $p = .08$	$\beta = .07$, SE = .09, t = .71, $p = .47$	$\beta = .13$, SE = .09, t = 1.34, $p = .18$
Hostility				
Step 1	$\beta = .22$, SE = .10, t = 2.28, $p = .02$	$\beta = .32$, SE = .12, t = 2.74, $p = .007$	$\beta = .22$, SE = .09, t = 2.31, $p = .02$	$\beta = .25$, SE = .09, t = 2.71, $p = .008$
Step 2	$\beta = 1.52$, SE = .29, t = 5.23, $p < .001$	$\beta = 1.31$, SE = .37, t = 3.49, $p = .001$	$\beta = 1.18$, SE = .29, t = 3.94, $p = .0002$	$\beta = .69$, SE = .32, t = 2.15, $p = .035$
Step 3	$\beta = .10$, SE = .04, t = 2.49, $p = .01$	$\beta = .09$, SE = .04, t = 2.51, $p = .01$	$\beta = .09$, SE = .04, t = 2.06, $p = 01$	$\beta = .09$, SE = .03, t = 2.84, $p = .01$
Step 4	$\beta = .07$, SE = .11, t = .65, $p = .51$	$\beta = .20$, SE = .12, t = 1.63, $p = .11$	$\beta = .11$, SE = .10, t = 1.04, $p = .30$	$\beta = .19$, SE = .09, t = 2.04, $p = .045$
Psychoticism				
Step 1	$\beta = .22$, SE = .10, t = 2.28, $p = .02$	$\beta = .32$, SE = .12, t = 2.74, $p = .007$	$\beta = .22$, SE = .09, t = 2.31, $p = .02$	$\beta = .25$, SE = .09, t = 2.71, $p = .008$
Step 2	$\beta = 3.62$, SE = .59, t = 6.03, $p < .001$	$\beta = 3.01$, SE = .80, t = 3.75, $p = .0004$	$\beta = 2.78$, SE = .63, t = 4.41, $p < .001$	$B = 2.53$, SE = .65, t = 3.90, $p = .002$
Step 3	$\beta = .08$, SE = .02, t = 3.57, $p = .0001$	$\beta = .06$, SE = .02, t = 3.48, $p = .001$	$\beta = .06$, SE = .02, t = 3.59, $p = .001$	$\beta = .06$, SE = .02, t = 3.47, $p = .001$
Step 4	$\beta = -.01$, SE = .11, t = −.12, $p = .89$	$\beta = .14$, SE = .11, t = 1.24, $p = .21$	$\beta = .05$, SE = .10, t = .51, $p = .61$	$\beta = .11$, SE = .09, t = 1.15, $p = .25$

Step 1, predictor on criterion; Step 2, predictor on mediator; Step 3, mediator on criterion; Step 4, predictor on criterion after controlling for mediator

Hostility (indirect effect = .15; 95 % BCa bootstrap CI .01–.29), subscale Psychoticism (indirect effect = .21; 95 % BCa bootstrap CI .10–.40).

The relationship between positive beliefs and Total Gambling Score was partially mediated by Obsessive–Compulsive subscale (indirect effect = .10; 95 % BCa bootstrap CI .01–.24), and fully mediated by Interpersonal Sensitivity sub scale (indirect

effect = .13; 95 % BCa bootstrap CI .03–.31), Anxiety subscale (indirect effect = .12; 95 % BCa bootstrap CI .01–.34), Hostility subscale (indirect effect = .12; 95 % BCa bootstrap CI .31–.40), Psychoticism subscale (indirect effect = .18; 95 % BCa bootstrap CI .05–.43).

The relationship between beliefs about the need to control and Total Gambling Score was fully mediated Obsessive–Compulsive subscale (indirect effect = .14; 95 % BCa bootstrap CI = .02–.28), Interpersonal Sensitivity subscale (indirect effect = .14; 95 % BCa bootstrap CI = .04–.28), Anxiety subscale (indirect effect = .15; 95 % BCa bootstrap CI = .05–.29), Hostility subscale (indirect effect = .11; 95 % BCa bootstrap CI = .008–.23), Psychoticism subscale (indirect effect = .17; 95 % BCa bootstrap CI = .06–.35).

The relationship between Cognitive Self-Consciousness and Total Gambling Score was fully mediated by Obsessive–Compulsive subscale (indirect effect = .10; 95 % BCa bootstrap CI = .02–.23), Interpersonal Sensitivity subscale (indirect effect = .11; 95 % BCa bootstrap CI = .03–.21), Anxiety subscale (indirect effect = .12; 95 % BCa bootstrap CI = .04–.24), Psychoticism subscale (indirect effect = .14; 95 % BCa bootstrap CI = .06–.26). The relationship between cognitive self-consciousness and Total Gambling Score was partially mediated by the Hostility subscale (indirect effect = .06; 95 % BCa bootstrap CI = .003–.16). Depression, Phobic Anxiety, Paranoid Ideation were not significant mediators of the relationship between metacognition and gambling.

Discussion

Although several studies dealt with the independent role of comorbid disorders (Johansson et al. 2009; Lorains et al. 2011) and metacognition (Lindberg et al. 2011) on the onset of pathological gambling, to our knowledge no research has assessed whether the presence of concurrent psychological disorders could have accounted for the associations between metacognition and pathological gambling. Our data showed a higher level of comorbid disorders (especially depression and anxiety disorders) of the pathological gamblers associated with an increase in the severity of gambling. Findings are consistent with previous studies showing that pathological gambling co-occurs frequently with mental health disorders, in particular with affective and anxiety disorders (Johansson et al. 2009; Lorains et al. 2011). Moreover, according to Lorains et al. (2011), the presence of comorbid conditions may produce difficulties for psychological and/or pharmacological treatments. Therefore, treatment providers should assess the comorbid conditions, thus evaluating a specific approach for gamblers with comorbid disorders. Finally, they have to consider whether the comorbid disorder precedes the gambling problems and, if so, whether that disorder would benefit from the treatment.

Furthermore, pathological gamblers reported high levels of metacognition indicating greater levels of maladaptation in metacognition, and some of the metacognitive factors (i.e., positive beliefs about worry, negative belief about thoughts concerning uncontrollability and danger, beliefs about the need to control thoughts, cognitive self-consciousness) were positively and significantly associated with both comobird disorders and PG. Interestingly, mediation analyses showed that the relationship between metacognitive factors and PG was fully explained by concurrent psychological disorders: high levels of metacognition are associated with an increase of comorbid mental disorders which, in turn, are predictors of high levels of PG. Specifically appears relevant the mediator role of

concurrent obsessive–compulsive, anxiety, interpersonal sensitivity, hostility and psychoticism symptoms.

Such findings were partially supported by a previous study according to which three types of metacognition seem to be implicated in psychological dysfunction: negative beliefs about thoughts concerning uncontrollability and danger, cognitive confidence, and beliefs about the need to control thoughts (Lindberg et al. 2011). Moreover, this study showed evidence of the role played by the metacognition in gambling contexts in line with recent studies that examined both the positive/negative metacognitive beliefs associated to desire thinking (Caselli and Spada 2010), and the awareness of own capacities involved in decision-making processes under uncertainty (Brevers et al. 2012, 2014).

These findings provide relevant clinical implications: MCT may be a potentially valuable treatment in problem gambling, being its focus the change of the erroneous metacognitive beliefs. A wide range of techniques may be used to accomplish these goals: for instance, interventions aimed at interrupting rumination, thought suppression and worry, change of the attentional control (e.g. attention training) or increase of the control capacity of gamblers' flexible thinking styles (e.g. detached mindfulness) (Wells 2009). MCT through the change of the metacognitive beliefs may reduce the comorbid disorders which, in turn, may lead to the reduction of PG.

In particular, our result suggest that MCT may to be considered as a potentially therapeutic strategy for the treatment of the concurrent obsessive–compulsive, anxiety, interpersonal sensitivity, hostility and psychoticism symptoms associated to pathological gambling.

However, this study presents some limitations: (a) it utilizes self-report inventories which allow individuals to hide their own feelings, thoughts, and attitudes also due to social desirability; (b) the patient sample size is limited. In spite of this, the presence of statistically significant data suggest their clinical relevance.

Future research should evaluate the application of MCT on pathological gamblers, that is, to assess whether some changes in metacognition during the MCT sessions are associated with the reduction of gambling behaviours, and if so, whether such changes could prevent relapses in a long run. It would also be better to investigate the role of other variables able to explain the relationship between metacognition and PG, i.e., metacognitive beliefs about the meaning of thought (thought-action fusion, thought-event fusion, thought-object fusion) and/or impulsivity.

Acknowledgments We would like express our gratitude to Antonello Taranto, Rossella Melpignano and Isabella Macina of the Department of Pathological Addictions of Local Health Board (AUSL, Bari, Italy) for making available their ambulatory.

Conflict interest All authors declare that they have no conflict of interest.

Integrity of research and reporting The study protocol was approved by the local ethic committee and all participants provided written informed consent.

References

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: American Psychiatric Association.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173–1182.

Bastiani, L., Gori, M., Colasante, E., Siciliano, V., Capitanucci, D., Jarre, P., et al. (2013). Complex factors and behaviors in the gambling population of Italy. *Journal of Gambling Studies, 29*(1), 1–13. doi:10.1007/s10899-011-9283-8.

Brevers, D., Cleeremans, A., Bechara, A., Greisen, M., Kornreich, C., Verbanck, P., & Noël, X. (2012). Impaired self-awareness in pathological gamblers. *Journal of Gambling Studies, 29*(1), 119–129.

Brevers, D., Cleeremans, A., Bechara, A., Greisen, M., Kornreich, C., Verbanck, P., & Noël, X. (2014). Impaired metacognitive capacities in individuals with problem gambling. *Journal of Gambling Studies, 30*(1), 141–152.

Capitanucci, D., & Carlevaro, T. (2004). *Guida ragionata agli strumenti diagnostici e terapeutici nel disturbo di gioco d'azzardo patologico*. Bellinzona: Hans Dubois.

Caselli, G., & Spada, M. M. (2010). Metacognitions in desire thinking: A preliminary investigation. *Behavioural and Cognitive Psychotherapy, 38*(5), 629–637.

Castrén, S., Basnet, S., Salonen, A. H., Pankakoski, M., Ronkainen, J. E., Alho, H., et al. (2013). Factors associated with disordered gambling in Finland. *Substance Abuse Treatment, Prevention, and Policy, 8*(1), 24. doi:10.1186/1747-597X-8-24.

Derogatis, L. R. (1977). *SCL-90-R: Administration, scoring, and procedure manual*. Baltimore: Johns Hopkins Press.

Derogatis, L. R. (1994). *Symptom checklist-90-R: Administration, scoring, and procedures manual* (3rd ed.). Minneapolis: National Computer Systems.

Gambino, B., & Lesieur, H. (2006). The South Oaks Gambling Screen (SOGS): A rebuttal to critics. *Journal of Gambling Issues*. doi:10.4309/jgi.2006.17.10.

Johansson, A., Grant, J. E., Kim, S. W., Odlaug, B. L., & Götestam, K. G. (2009). Risk factors for problematic gambling: A critical literature review. *Journal of Gambling Studies, 25*(1), 67–92. doi:10.1007/s10899-008-9088-6.

Lesieur, H., & Blume, S. (1987). The South Oaks Gambling Screen (SOGS): A new instrument for the identification of pathological gamblers. *American Journal of Psychiatry, 144*(9), 1184–1188.

Lindberg, A., Fernie, B. A., & Spada, M. M. (2011). Metacognitions in problem gambling. *Journal of Gambling Studies, 27*(1), 73–81. doi:10.1007/s10899-010-9193-1.

Lorains, F. K., Cowlishaw, S., & Thomas, S. A. (2011). Prevalence of comorbid disorders in problem and pathological gambling: Systematic review and meta-analysis of population surveys. *Addiction, 106*(3), 490–498. doi:10.1111/j.1360-0443.2010.03300.x.

MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods, 7*(1), 83–104.

Morrison, A. P., Wells, A., & Nothard, S. (2000). Cognitive factors in predisposition to auditory and visual hallucinations. *British Journal of Clinical Psychology, 39*(Pt1), 67–78.

Papageorgiou, C., & Wells, A. (2003). An empirical test of a clinical metacognitive model of rumination and depression. *Cognitive Therapy and Research, 27*(3), 261–273.

Petry, N. M. (2005). *Pathological gambling: Etiology, comorbidity and treatments*. Washington, DC: American Psychological Association Press.

Preacher, K., & Hayes, A. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers, 36*(4), 717–731.

Preti, E., Prunas, A., & Sarno, I. (2012). La SCL-90-R: Una copertura quasi completa dello spettro psicopatologico. http://items.giuntios.it/showArticolo.do?idArt=180&pg=2

Prunas, A., Sarno, I., Preti, E., Madeddu, F., & Perugini, M. (2012). Psychometric properties of the Italian version of the SCL-90-R: A study on a large community sample. *European Psychiatry, 27*(8), 591–597. doi:10.1016/j.eurpsy.2010.12.006.

Raylu, N., & Oei, T. P. S. (2002). Pathological gambling. A comprehensive review. *Clinical Psychology Review, 22*(7), 1009–1061. doi:10.1016/S0272-7358(02)00101-0.

Roussis, P., & Wells, A. (2006). Post-traumatic stress symptoms: Tests of relationships with thought control strategies and beliefs as predicted by the metacognitive model. *Personality and Individual Differences, 40*(1), 111–122. doi:10.1016/j.paid.2005.06.019.

Spada, M. M., Caselli, G., & Wells, A. (2009). Metacognitions as a predictor of drinking status and level of alcohol use following CBT in problem drinkers: A prospective study. *Behaviour Research and Therapy, 47*(10), 882–886. doi:10.1016/j.brat.2009.06.010.

Spada, M. M., Mohiyeddini, C. & Wells, A. (2008). Measuring metacognitions associated with emotional distress: Factor structure and predictive validity of the Metacognitions Questionnaire 30. *Personality and Individual Differences*, *45*(3), 238–242. doi:10.1016/j.paid.2008.04.005.

Spada, M. M., Nikčević, A. V., Moneta, G. B., & Wells, A. (2007). Metacognition as a mediator of the relationship between emotion and smoking dependence. *Addictive Behaviors, 32*(10), 2120–2129. doi:10.1016/j.addbeh.2007.01.012.

Stinchfield, R. (2002). Reliability, validity, and classification accuracy of the South Oaks Gambling Screen (SOGS). *Addictive Behaviors, 27*(1), 1–19. doi:10.1016/S0306-4603(00)00158-1.
Wells, A. (1995). Meta-cognition and worry: A cognitive model of generalized anxiety disorder. *Behavioural and Cognitive Psychotherapy, 23*(3), 301–320. doi:10.1017/S1352465800015897.
Wells, A. (2000). *Emotional disorders and metacognition: Innovative cognitive therapy*. Chichester: Wiley.
Wells, A. (2005). The metacognitive model of GAD: Assessment of meta-worry and relationship with DSM-IV generalized anxiety disorder. *Cognitive Therapy and Research, 29*(1), 107–121.
Wells, A. (2009). *Metacognitive therapy for anxiety and depression*. New York: The Guilford Press.
Wells, A. (2012). *Terapia Metacognitiva dei disturbi d'Ansia e della Depressione*. Firenze: Eclipsi.
Wells, A., & Cartwright-Hatton, S. (2004). A short form of the meta-cognitions questionnaire: Properties of the MCQ-30. *Behavior Therapy, 42*(4), 385–396. doi:10.1016/S0005-7967(03)00147-5.
Wells, A., & Papageorgiou, C. (1998). Social phobia: Effects of external attention on anxiety, negative beliefs, and perspective taking. *Behavior Therapy*, *29*, 357–370. doi:10.1016/S0005-7894(98)80037-3.