

IMPULSIVITY AND METACOGNITION IN A PSYCHIATRIC POPULATION

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Abstract

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Objective: The main purpose of this study was to examine a possible relationship among the three constructs of impulsivity, according to Barratt's theory and metacognition subdimensions, as described in Wells and Cartwright – Hatton's theory, in various psychiatric disorders, in order to explore the potential predictive role of impulsivity on metacognition.

Method: The Barratt Impulsiveness Scale-11 (BIS-11) and the Metacognitions Questionnaire (MCQ-30) were administered to a sample of 100 patients affected by psychiatric disorders. Linear regression was used first to study the relationship between impulsivity as an independent variable and metacognition as a dependent variable and then to evaluate the relationship between the three construct of impulsivity and the five subdimensions of metacognition.

Results: BIS-11 total score was a valid predictor of Total MCQ-30 ($p < .0001$), whereas Attentive Impulsiveness was a good predictor of the factors "Negative Beliefs" ($p < .0001$), "Cognitive Confidence" ($p = .004$) and "Need to control thoughts" ($p = .002$).

Conclusions: since "Attentive Impulsiveness", "Negative believes", "Cognitive Confidence" and "Need to Control Thought" are psychological constructs, psychotherapy is the more effective tool to intervene on their imbalance. In particular, literature demonstrates the effectiveness of Cognitive-Behavioural Therapy and Mindfulness therapies in rebalancing impulsivity and enhancing metacognitive skills.

Key words: impulsivity, metacognition, attentional impulsiveness, negative beliefs, cognitive confidence, need to control

Citation: Turiaco, F., Bruno, A., Mento, C., Cedro, C., Pandolfo, G., Muscatello, M. R. A. (2022). Impulsivity and metacognition in a psychiatric population. *Clinical Neuropsychiatry*, 19(2), 97-102.

doi.org/10.36131/cnfiortieditore20220203

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Funding: None.

Competing interests: None.

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Introduction

Impulsivity is a multifaceted psychobiological construct whose key domains or facets have been differently identified and defined according to various theoretical and neurobiological models within the scientific literature. As a multidimensional trait, impulsivity is characterized by several dimensions, each of which is

proposed to have an independent contribution to the development of behavioural and psychiatric disorders; main dimensions are lack of inhibitory control, attention deficit, difficulty in decision-making and delaying reward (De Wit, 2009). Stahl et al. (2014), using a structural-equation modelling approach, described five different components of impulsivity: control of stimulus interference, proactive interference, response interference, decisional and motivational impulsivity; impulsive behaviours are influenced by negative feelings, a significant, yet underreported feature (Sebastian et al., 2014).

In general population, high levels of impulsivity have been linked to worse life outcomes, such as lower levels of academic achievement (Duckworth

& Seligman, 2005) and, nowadays, the key role of impulsivity in the onset, course and outcome of many psychopathological disorders is well known. Impulsivity is a core dimension in Borderline Personality Disorder (BPD), being considered both as a predictor of remission and a risk factor for suicide, and playing a fundamental role in either self-directed or outwardly directed aggressive behaviours (Mungo et al., 2020). Similarly, impulsivity characterizes aggression in psychotic and manic episodes (Reddy et al., 2014). In schizophrenia spectrum disorders, impulsivity is mainly the consequence of cognitive deficits, altered reward processing, and distortions in the ability to acquire information (Cheng et al., 2012). Patients with bipolar disorder, on the other hand, often display behaviours characterized by impulsivity and enhanced reward seeking not otherwise balanced by planning skills; risky-impulsive behaviour is listed as a diagnostic criterion for mania (DSM-5). Individual differences in impulsivity and in its facets are consistently identified as key factors in the initiation and maintenance of substance use, misuse, and dependence. According to the results from genetic studies, polymorphism of dopamine receptor D2 (DRD2) impulsivity has been

proposed as an endophenotype potentially influencing the development of Substance Use Disorders (SUD) (Kozak et al., 2019), whereas several mutations of serotonergic and dopaminergic receptors can play a role in impulsive behaviours observed in other psychiatric disorders (Pavlov et al., 2012). From a neuroanatomical point of view, two neuronal systems are involved in impulsivity: the Behavioural Inhibition System (BIS) and the Behavioural Approach System (BAS). The BAS includes the striatum, the thalamus and cortical areas; the system regulates excitation and behavioural activation and it is associated with the reward seeking system, so that subjects with a low threshold of activation of the BAS are more impulsive and less inhibited in situations where gratification is expected.

The BIS entails the frontal lobe, the middle brain and neocortical projections. Its activity is affected by anxiety and frustration, and consists in the display of avoidance behaviours in those situations that could generate aversive experiences (Li et al., 2019). The role of prefrontal regions in the regulation of impulsivity deserves particular attention, especially when considering the main areas involved: ventro-lateral prefrontal cortex (VLPFC), dorso-lateral prefrontal cortex (DLPFC), inferior frontal junction (IFJ), the insula, orbito-frontal cortex (OFC), ventro-medial prefrontal cortex (VMPFC), the anterior cingulate cortex ACC, and the pre-supplementary motor area (pre-SMA). Specifically, the right hemisphere controls the behavioural component of impulsivity, while the other components are modulated bilaterally (Sebastian et al., 2014); however, the wide involvement of frontal areas in the modulation of the BAS and BIS systems and, consequently, of approach and avoidance behaviours explains the key role of the integrity of cognitive and executive functions in the regulation of impulsivity. Within this context, metacognition, a higher order function which involves executive control over the cognitive processes and self-regulation, may have a potential role in the modulation of behaviours, including impulsive ones. Metacognition can be considered as a multifaceted construct including metacognitive knowledge, monitoring, and control. The first facet refers to people's knowledge, awareness and understanding of various cognitive processes. Metacognitive monitoring is the ability to evaluate cognitive activity, whereas metacognitive control is the ability to regulate and control thoughts and other internal dynamics. Fonagy and Batheman (2016) describe it as the capacity to "mentalize", considered as the ability to understand one's own and other people's mental states. Mentalization, according to the Authors, is not a static and unitary function, it is rather dynamic and multifaceted, and it plays a main role within the context of attachment relationships, where secure attachment lays the foundations for a mature mentalization.

Five subdimensions of metacognition have been described and resulted potentially measurable: Positive Believes about worry, that is perceiving worry as a useful strategy of coping; Negative Believes about discontrol and danger; Cognitive Confidence, that consists in how much people trust their memory and attention; Need to Control thoughts, mainly referred to those thoughts that generate discomfort and anguish and, finally, Cognitive Self-Consciousness, or awareness about the process of thinking (Wells & Cartwright – Hatton 2004). Tracing the neuroanatomical basis of metacognition is a complex task; the left ventro-lateral prefrontal cortex, right dorsolateral prefrontal cortex, insula, putamen and pre-motor cortex, have been indicated as key areas

for metacognitive processes, along volumetric features of grey matter and white matter of prefrontal cortex (Spalletta et al., 2014).

Defective metacognitive abilities have been related with the development, maintenance, and outcome of various mental disorders, including personality disorders. Furthermore, they seem to have a role in treatment adherence and response, also when considering non-pharmacological treatments, such as psychotherapy, where the lack of metacognitive function is related with higher rates of drop-outs; thus, improving metacognition can be a goal for improving patients' outcomes (Carcione et al. 2019). When considering the influence of cognitive and metacognitive beliefs on the perception of the whole spectrum of psychological functioning, and on the modulation of attention, memory, self-appraisal and self-confidence in response to internal and external stimuli, it derives that many psychiatric disorders are facilitated and maintained by defective metacognitive abilities that can involve alterations in the processing of environmental and social stimuli (James et al., 2016; McEvoy, 2019).

A little amount of evidence exists about the possible reciprocal influences and interplay between metacognition and impulsivity. Ermiş and İcelioglu (2017) showed that neuroticism and psychoticism as personality traits affected metacognitive processes which were further influenced by individual differences in impulsivity; specifically, impulsive traits affected awareness and self-perception of cognitive abilities.

Based on this background, the present study was aimed at investigating the role of impulsivity and metacognition in a sample of patients with psychiatric disorders, exploring potential associations between the two constructs, and starting from the research hypothesis that impulsivity may be a predictive factor of metacognition.

Materials and methods

Sample

Participants were recruited through the convenience sampling method. Patients, aged between 18 and 65 years, referred to the Psychiatry Unit of the University Hospital "G. Martino" of Messina from January to June 2021, were consecutively included in the study. None of the subjects evaluated presented, at the time of enrolment, pathologies that could interfere with the outcome of the study protocol (including significant concomitant medical conditions, organic brain disorders, neurocognitive disorder, history of alcohol or substance addiction). The study was introduced to the participants as an investigation into impulsivity and ability to understand reasoning; they were asked to answer self-report questionnaires anonymously. The research protocol was conducted in accordance with the Helsinki Declaration; all patients participating in the study regularly provided written informed consent.

Psychodiagnostic tools

All participants were subjected to evaluation using the following instruments:

- Metacognitions Questionnaire - MCQ-30 (citazione): a short-version, self-report measure derived from the full version of the MCQ (Cartwright-Hatton & Wells, 1997). MCQ-30 consists of 30 items scored on a four-point Likert scale (1 = do not agree; 2 =

agree slightly; 3 = agree moderately; 4 = agree very much), and organised in five subscales:

1. Positive Beliefs: concerning for a stressful situation is considered as a useful coping strategy (i.e.: "Worrying helps me to avoid problems in the future");
2. Negative Beliefs: the subject considers the possible uncontrollability of his/her feelings as worrying (i.e.: "My worrying is dangerous for me");
3. Cognitive Confidence: the subject lacks confidence in his/her memory, attention, and other cognitive skills (i.e.: "I have little confidence in my memory for words and names");
4. Need to Control thoughts: the subject believes that the control of his/her thoughts is fundamental (i.e.: "I should be in control of my thoughts all of the time");
5. Cognitive Self-Consciousness: the subject's awareness of his/her thoughts and thought processes (i.e.: "I think a lot about my thoughts").

Subscales scores range between 6 and 24; higher subscales scores identify the preferentially used coping strategies (Quattropiani et al., 2014). MCQ-30 has good psychometric characteristics (Wells & Cartwright – Hatton, 2004).

- Barratt Impulsiveness Scale - BIS-11 (Patton et al., 2015): a 30 items, self-report scale scored on a 4-point scale (1 = rarely/never; 2 = occasionally; 3 = often; 4 = almost always/always), that measures impulsivity in three second-order constructs:

1. Attentional Impulsiveness (score range = 8-32): lack of attention and cognitive instability (i.e., I am restless at the theater or lectures);
2. Motor Impulsiveness (score range = 11-44): tendency to act the impulsive stimulus (i.e., "acting on the spur of the moment");
3. Non-planning impulsiveness (score range = 11-44): outlined as a poor evaluation of the consequences of an action and planning difficulties (i.e., "acting on the spur of the moment").

Total score ranges from 30 to 120; mean scores of 63.8 + 10.2 are reported in the general population, 69.3 + 10.3 in subjects with abusive behaviours, 71.4 + 12.6 in psychiatric patients and 76.3 + 11.9 in male inmates. The internal consistency (Cronbach's $\alpha = .79$) and two-month re-test reliability coefficients ($r = .889$, $p < .001$) of the BIS-11 Italian translation were satisfactory (Fossati et al., 2001).

Statistical analysis

Only the completers' data have been included in the statistical analysis. Continuous data were expressed as mean \pm standard deviation, while categorical variables were reported as percentages. A first linear regression analysis, with the total score of the MCQ-30 as a dependent variable and the total score of the BIS-11 as an independent variable, was performed to determine the possible predictive role of impulsivity on metacognitive abilities. A second linear regression analysis, in which the MCQ-30 factor values were considered dependent variables and all the BIS-11 constructs were included in the equation, was performed to assess what kind of impulsivity could play the role of specific predictor towards the different dimensions of metacognition. The results for $p < .05$ were considered significant. Statistical analysis was performed with the Statistical

Package for the Social Sciences - SPSS 25.0 software (SPSS Inc, Chicago, IL, USA).

Results

From a pool of 153 eligible patients, 31 refused to participate and 22 patients were excluded because of their incomplete questionnaires. **Table 1** shows the sociodemographic features of the sample. The final sample, consisting in 52 males (52%) and 48 females (48%), was characterized by a mean age of 43.87 years (\pm S.D. = 15.8), and a mean duration of illness of 17.82 years (\pm S.D. = 9.7). Regarding to mental disorders, the category most represented was "Anxiety disorders" (28%), followed by "Depressive disorder" (24%), "Personality disorders" (17%), "Bipolar disorder" (13%), and "Schizophrenia and other psychotic disorders" (12%), whereas "Obsessive-Compulsive Disorder" was scarcely represented (3%).

Table 1. Demographic and clinical characteristics

Subjects eligible/enrolled, N	153/100
Gender (M/F), %	52/48
Age (years), mean (\pm SD)	43.87 (\pm 15.8)
Duration of illness (years), mean (\pm SD)	17.82 (\pm 9.7)
Educational level, %	
Secondary school	46
Lower secondary school	41
Primary school	13
Mental disorders, %	
Anxiety disorders	28
Depressive disorder	24
Personality disorders	17
Bipolar disorder	13
Schizophrenia and other psychotic disorders	12
Obsessive-Compulsive Disorder	3

Table 2 reports the mean subscales scores of the psychodiagnostic tools administered. In the examined sample, the most used coping strategies were "Cognitive Self-Consciousness" (16.67 ± 3.95) and "Negative Beliefs" (15.23 ± 5.25). Concerning BIS-11, according to score ranges, mean subscales values lie within the normal ranges for all components of impulsivity.

Table 2. Descriptive statistics (mean \pm SD) of MCQ-30 and BIS-11 subscales scores in the total sample (n = 100)

	Min	Max	Mean	D.S.	Range
MCQ-30					
• Positive Beliefs	3	24	11,31	4,52	-
• Negative Beliefs	6	24	15,23	5,25	-
• Cognitive Confidence	6	24	13,47	5,50	-
• Need to Control	6	24	14,73	4,24	-
• Cognitive Self-Consciousness	6	24	16,67	3,95	-
BIS-11					
✓ Attentional Impulsiveness	8	31	17,95	5,20	8-32
✓ Motor Impulsiveness	14	38	23,06	5,66	11-44
✓ Non-planning impulsiveness	16	87	28,10	7,95	11-44

Table 3 reports the linear regression analysis performed to evaluate the possible association between the total score of the BIS-11 and the total score of the MCQ-30: the results indicated that the model represented 12.1% of the variance of the MCQ-30 Total ($F = 13,471$; $df = 1$; $p < .0001$) and that the total score of the BIS-11 constituted a valid predictor of Total MCQ-30 ($p < .0001$).

Table 3. Linear regression analysis

Dependent Variable	Predictor	Unstandardized coefficients		Standardized coefficients		
		B	S.E.	Beta	t	p
MCQ-30 Total^a (Model 1)	(Constant)	43,122	7,867		5,481	,000
	BIS-11 Total	,409	,112	,348	3,670	,000

^a $R = .348$; $F = 13.471$; $p < .0001$

Table 4 reports the linear regression analysis performed to evaluate the possible associations between the three constructs of the BIS-11 and the five factors of the MCQ-30: the statistical analysis showed that, among the specific constructs of impulsivity measured with the BIS-11, only Attentive Impulsivity represented a good predictor of the MCQ-30 factors “Negative Beliefs” ($p < .0001$), “Cognitive Confidence” ($p = .004$) and “Need to control thoughts” ($p = .002$); the other dimensions of impulsivity did not contribute as predictors to the dimensions of metacognition.

Table 4. Linear regression analysis

Dependent Variable	Predictors	Unstandardized coefficients		Standardized coefficients		
		B	S.E.	Beta	t	p
Positive Beliefs^a (Model 1)	(Constant)	7,956	2,265		3,513	,001
	Attentional Impulsiveness	,151	,112	,174	1,348	,181
	Motor Impulsiveness	,062	,101	,077	,608	,545
	Non-planning impulsiveness	-,028	,059	-,049	-,471	,639
Negative Beliefs^b (Model 2)	(Constant)	4,122	2,237		1,843	,068
	Attentional Impulsiveness	,516	,111	,511	4,652	,000
	Motor Impulsiveness	,054	,100	,058	,542	,589
	Non-planning impulsiveness	,021	,058	,032	,361	,719
Cognitive Confidence^c (Model 3)	(Constant)	1,216	2,422		,502	,617
	Attentional Impulsiveness	,358	,120	,338	2,980	,004
	Motor Impulsiveness	,204	,108	,210	1,885	,063
	Non-planning impulsiveness	,040	,063	,057	,629	,531
Need to Control^d (Model 4)	(Constant)	9,510	1,968		4,832	,000
	Attentional Impulsiveness	,316	,098	,387	3,238	,002
	Motor Impulsiveness	,067	,088	,090	,765	,446
	Non-planning impulsiveness	-,071	,051	-,134	-1,388	,168
Cognitive Self-Consciousness^e (Model 5)	(Constant)	21,031	1,951		10,778	,000
	Attentional Impulsiveness	-,134	,097	-,176	-1,383	,170
	Motor Impulsiveness	,032	,087	,045	,362	,718
	Non-planning impulsiveness	-,096	,051	-,192	-1,875	,064

^a $R = .221$; $F = 1.639$; $p = .185$; ^b $R = .559$; $F = 14.554$; $p < .0001$; ^c $R = .516$; $F = 11.603$; $p < .0001$; ^d $R = .429$; $F = 7.220$; $p < .0001$; ^e $R = .275$; $F = 2.626$; $p = .055$

Discussion

The aim of this study was to find possible relationships between the dimensions of metacognition and impulsivity in a sample of subjects affected by various mental disorders.

Regarding metacognition, as assessed by the MCQ-30, the study sample was characterized by the prevalent use of the coping mechanisms "Cognitive Self-Consciousness" and "Negative Beliefs", defined as the ability to be aware of one's own mental contents, and an exaggerated apprehension about the possible uncontrollability of one's own feeling and thoughts, respectively. Literature on the use of peculiar coping strategies by psychiatric patients has provided contrasting results; however, a number of studies showed that metacognitive dimensions are transversely linked to mental disorders. Aydin et al. (2019) found that "Negative beliefs" coping mechanism characterized Panic Disorder, whereas "Need to control" was more represented in Obsessive-Compulsive Disorder (OCD) and Generalized Anxiety Disorder (GAD). Results from a study aimed at exploring differences in metacognitive beliefs among patients with schizophrenia and auditory hallucinations, patients with schizophrenia and persecutory delusions, patients affected by panic disorder, and controls showed that psychotic patients with auditory hallucinations were more dysfunctional in the various metacognitive domains than other patient groups, scoring significantly higher on Positive Beliefs about worry, Negative Beliefs about the controllability of thoughts and corresponding danger, and Cognitive Confidence (Morrison and Wells, 2003). Patients with

auditory hallucinations also scored significantly higher than healthy subjects on Cognitive Self-Consciousness, consistently with the hypothesis that metacognitions are generally related with psychological disturbances. The metacognitive dimension of Negative Beliefs about the controllability of thoughts and corresponding danger, along with pathological worry, has been further associated with GAD, and with the OCD's washing compulsions symptomatic domain, whereas Positive Beliefs about worry was associated with checking compulsions (Wells & Papageorgiou, 1998; Wells and Carter, 2001). Within this context, if Negative Beliefs could represent a control strategy aimed at reducing anxiety toward perceived uncontrollability, the association between Positive Beliefs about worry and checking, an anticipatory behaviour for avoiding damages, reveals the nature of checking both as a counterpart of worry and as an avoidance and coping function. A previous study demonstrated that patients with hypochondria exhibited high scores in Need to Control thoughts (Bouman & Meijer, 1999).

Regarding impulsivity, our sample was characterized by within-range mean scores on Attentional, Motor, and Non-planning Impulsiveness as assessed by the BIS-11.

In order to evaluate the predictive value of impulsivity on metacognition, a linear regression analysis was performed assuming impulsivity as the independent variable, and metacognition as the dependent variable; results showed an inversely proportional trend with the greater the impulsivity, the lower the metacognitive ability. These data are congruent with the available, yet scarce, literature on these topics (Ermiş & İcellioğlu, 2017). Further regression analyses including BIS-11 and MCQ-30 subscale scores showed that Attentional Impulsiveness was a significant predictor of Negative Beliefs, Cognitive Confidence, and Need for Control. Thus, a specific construct of impulsivity seems to be a direct predictor of the size of metacognition impairment; within this frame, attentional impulsivity may enhance the use of maladaptive coping mechanisms as identified by the different MCQ-30 subdimensions; this appears to be transversally applicable to the various mental disorders included in the study.

This seems to be the most interesting and significant result that emerged from our study, since it implies possible transdiagnostic treatment perspectives for those psychiatric disorders in which metacognitive deficits and/or dysfunctions derive from the presence of excessively dominant impulsive traits. Our data need to be cautiously interpreted, since they cannot be entirely matched with the current literature; actually, no studies have compared possible associations among metacognition domains and impulsivity factors. However, addressing impulsivity as a therapeutic target may indirectly improve metacognition. The efficacy of Cognitive-Behavioural therapy and Mindfulness in ameliorating metacognitive abilities is well documented; furthermore, also cognitive-behavioral techniques may offer effective intervention strategies on Attentional Impulsivity, a dimension strictly linked to poor performances in several areas of patients' functioning. The proposed mechanisms involved in the therapeutical effectiveness of the above-mentioned treatments seep through the acquisition of compensatory behavioral and cognitive techniques for improving central attention and executive deficits by modifying distorted negative beliefs that promote emotional maladjustment. As usual in cognitive-behavioural treatments (CBT), interventions are organized in relatively short and targeted structured protocols. Most adult CBT programs require 8 to 12 sessions and can be delivered on an individual or group basis. CBT programs are therefore usually organized into several modules with specific techniques for a range

of targeted problems. Most treatments begin with a psychoeducational module in which patients are educated about the disorder and introduced to the motivations of the treatment. This is followed by an organizational module designed to support the acquisition of different executive techniques such as goal setting, sequencing and prioritization, defining a time schedule, using a calendar or agenda, creating to-do lists, tracking progress and rewards. Patients also learn problem-solving techniques to effectively deal with problems, generating a list of potential solutions, evaluating them, and finally testing the chosen solution. The distraction management module helps patients to recognize their optimal attention span and to organize tasks accordingly, and suggests skills to cope with distractions such as writing them and return to the task, using signals or alarms, or changing environmental factors. The impulsivity management module includes strategies for self-monitoring and self-control. The self-monitoring module involves the detection of signals and situations that act as triggers for impulsive behaviors, whereas the self-control strategies refer to the use of self-instructions, relaxation techniques, or other alternative behaviors. The cognitive restructuring module is aimed at helping patients to become aware of those beliefs that reinforce maladaptive behaviors and emotions, ultimately replacing them with more adaptive thoughts (Lopez et al., 2018). Regarding Mindfulness, in recent decades there has been a surge of interest on its positive effects on cognitive functioning. A common goal of various Mindfulness techniques is the adoption of a non-reactive, observant stance towards one's emotions, thoughts and body states, as well as the self-regulation of attention. Therefore, on a conceptual basis, it can be argued that this technique can offer benefits by improving behavioral control and reducing impulsivity. Numerous studies in healthy individuals (Valentine & Sweet, 1999; Jha et al., 2007) and in patients with ADHD (Zylowska et al., 2008) have found evidence that Mindfulness can improve attention and reduce Active Impulsivity.

Our results should be interpreted with caution due to several limitations, such as the relatively small sample size which does not allow to adequately cover the full spectrum of psychiatric diagnoses, thus the results may not be representative of different mental disorders. Another limitation derives from the use of self-report instruments that may be vulnerable to individual factors which interfere with the validity of self-evaluation, such as social desirability, filtered and subjective rater perceptions, and lack of discrimination among behaviors.

Beyond the limitations, our data provide preliminary evidence on the importance of the attentional component of impulsivity as a psychological construct affecting specific metacognition in psychiatric patients. This finding contributes to improve theoretical knowledge on the relationship between impulsivity and metacognitive dimensions, with subsequent practical implications in terms of treatment strategies, thus providing insight on a range of psychological techniques, such as CBT and Mindfulness, aimed at rebalancing metacognition by addressing and treating impulsivity.

References

- Aydın, O., Balıkcı K., Poyraz Çökmüş, F., Ünal Aydın, P. (2019). The evaluation of metacognitive beliefs and emotion recognition in panic disorder and generalized anxiety disorder: effects on symptoms and comparison with healthy control. *Nord Journal Psychiatry*, 73(4-5):293-301. DOI:10.1080/08039488.2019.1623317.
- Bouman, T. K., & Meijer, K. J. (1999). A preliminary study

- of worry and metacognitions in hypochondriasis. *Clinical Psychology & Psychotherapy*, 6(2), 96–101. DOI:10.1002/(sici)1099-0879(199905)6:2<96::aid-cpp190>3.0.co;2-g
- Carcione, A., Riccardi, I., Bilotta, E., Leone, L., Pedone, R., Conti, L., Colle, L., Fiore, D., Nicolò, G., Pellicchia, G., Procacci, M & Semerari A. (2019). Metacognition as a Predictor of Improvements in Personality Disorders. *Frontiers in Psychology*, 8, 10:170. DOI: 10.3389/fpsyg.2019.00170.
- Cartwright-Hatton, S., & Wells, A. (1997). Beliefs about worry and intrusions: the metacognitions questionnaire and its correlates. *Journal of Anxiety Disorders*, 11(3), 279–96. DOI: 10.1016/s0887-6185(97)00011-x.
- Cheng, G.L.F., Tang, J. C. Y., Li, F. W. S., Lau, E. Y. Y., Lee & T. M. C. (2012). Schizophrenia and risk-taking: impaired reward but preserved punishment processing. *Schizophrenia Research*, 136(1-3):122-7. DOI: 10.1016/j.schres.2012.01.002.
- De Wit, H. (2009). Impulsivity as a determinant and consequence of drug use: a review of underlying processes. *Addiction Biology*, 14(1):22-31. DOI: 10.1111/j.1369-1600.2008.00129.x.
- Duckworth, A. L. & Seligman, M.E. (2005). Self-discipline outdoes IQ in predicting academic performance of adolescents. *Psychological Science*, 16(12):939-44. DOI: 10.1111/j.1467-9280.2005.01641.x.
- Ermis, E. N. & Icellioglu, S. (2017). Examining the predictive effect of impulsivity levels and personality traits on metacognitive thoughts. *Global Journal of Psychology Research New Trends and Issues*, 6(4):202. DOI: 10.1371/journal.pone.0191422.
- Fonagy, P. & Batheman, A. W. (2016). Adversity, Attachment, and Mentalizing. *Comprehensive Psychiatry*, 64, 59-66. DOI: 10.1016/j.comppsy.2015.11.006.
- Fossati, A., Di Ceglie, A., Acquarini, E., & Barratt, E. S., (2001). Psychometric properties of an Italian version of the Barratt Impulsiveness Scale-11 (BIS-11) in nonclinical subjects. *Journal of Clinical Psychology*, 57(6), 815–828.
- Jha A. P., Krompinger J. & Baime M. J. (2007). Mindfulness training modifies subsystems of attention. *Cognitive, Affective & Behavioral Neuroscience*, 7(2):109-19. DOI: 10.3758/cabn.7.2.109
- James, A. V., Hasson-Ohayon, I., Vohs, J., Minor, K. S., Leonhardt, B. L., Buck, K. D., George, S. & Lysaker, P. H. (2016). Metacognition moderates the relationship between dysfunctional self-appraisal and social functioning in prolonged schizophrenia independent of psychopathology. *Comprehensive Psychiatry*, 69, 62-70. DOI: 10.1016/j.comppsy.2016.05.008.
- Kozak, K., Lucatch, A. M., Lowe, D. J. E., Balodis, I. M., MacKillop, J. & George T. P. (2019). The neurobiology of impulsivity and substance use disorders: implications for treatment. *Annals of the New York Academy of Sciences*, 1451(1), 71–91. DOI: 10.1111/nyas.13977.
- Li, Q., Dai, W., Zhong, Y., Wang, L., Dai, B. & Liu, X. (2019). The mediating role of coping styles on impulsivity, Behavioral Inhibition/Approach System, and Internet Addiction in adolescents from a gender perspective. *Frontiers in Psychology*, 24, 10, 2402. DOI: 10.3389/fpsyg.2019.02402.
- Lopez P. L., Torrente F. M., Ciapponi A., Lischinsky A. G., Cetkovich-Bakmas M., Rojas J. I., Romano M. & Manes F. F. (2018). Cognitive-behavioural interventions for attention deficit hyperactivity disorder (ADHD) in adults. *Cochrane Database of Systematic Reviews* 23, 3(3), CD010840. DOI:10.1002/14651858.CD010840.pub2
- McEvoy, P. M. (2019). Metacognitive Therapy for Anxiety Disorders: a Review of Recent Advances and Future Research Directions. *Current Psychiatry Report*, 18;21(5):29. DOI: 10.1007/s11920-019-1014-3.
- Morrison, A. P., & Wells, A. (2003). A comparison of metacognitions in patients with hallucinations, delusions, panic disorder, and non-patient controls. *Behaviour Research and Therapy*, 41(2), 251–256. DOI:10.1016/s0005-7967(02)00095-5
- Mungo, A., Hein, M., Hubain, P., Loas, G. & Fontaine, P. (2020). Impulsivity and its Therapeutic Management in Borderline Personality Disorder: a Systematic Review. *Psychiatric Quarterly*, 91(4), 1333-1362. DOI: 10.1007/s11126-020-09845-z.
- Patton, J. H., Stanford, M. S. & Barratt, E. S. (1995). Factor Structure of the Barratt Impulsiveness Scale. *Journal of Clinical Psychology*, 51(6), 768-74. DOI: 10.1002/1097-4679(199511)51:6<768::aid-jclp2270510607>3.0.co;2-1.
- Pavlov, K. A., Chistiakov, D. A. & Chekhonin, V. P. (2012). Genetic determinants of aggression and impulsivity in humans. *Journal of Applied Genetics*, 53, 61–82. DOI: 10.1007/s13353-011-0069-6.
- Quattropiani, M. C., Lenzo, V., Mucciardi, M., Toffle, M. E. (2014). Psychometric properties of the Italian version of the Short Form of the Metacognitions Questionnaire (MCQ-30). *Applied Psychology Bulletin n. 269*. https://www.researchgate.net/publication/281908066_Psychometric_properties_of_the_Italian_version_of_the_Short_Form_of_the_Metacognitions_Questionnaire_MCQ-30.
- Reddy, L.F., Lee, J., Davis, M.C., Altshuler, L., Glahn, D.C., Miklowitz, D. J. & Green, M.F. (2014). Impulsivity and Risk Taking in Bipolar Disorder and Schizophrenia. *Neuropsychopharmacology*, 39(2), 456-63. DOI: 10.1038/npp.2013.218.
- Sebastian, A., Jung, P., Krause-Utz, A., Lieb, K., Schmahl, C. & Tüscher, O. (2014). Frontal dysfunctions of impulse control - a systematic review in borderline personality disorder and attention-deficit/hyperactivity disorder. *Frontiers in Human Neurosciences*, 3, 8, 698. DOI: 10.3389/fnhum.2014.00698.
- Spalletta, G., Piras, F., Piras, F., Caltagirone, C. & Orfei, M.D. (2014). The Structural Neuroanatomy of Metacognitive Insight in Schizophrenia and Its Psychopathological and Neuropsychological Correlates. *Human Brain Mapping*, 35(9), 4729-40. DOI: 10.1002/hbm.22507.
- Stahl, C., Voss, A., Schmitz, F., Nuszbaum, M., Tüscher, O., Lieb, K., & Klauer, C.H. (2014). Behavioral components of impulsivity. *Journal of Experimental Psychology General*, 143(2), 850-86. DOI: 10.1037/a0033981.
- Valentine, E. R., & Sweet, P. L. G. (1999). Meditation and attention: A comparison of the effects of concentrative and mindfulness meditation on sustained attention. *Mental Health, Religion & Culture*, 2(1), 59–70. <https://doi.org/10.1080/13674679908406332>
- Wells, A., & Carter, K. (2001). Further tests of a cognitive model of generalized anxiety disorder: Metacognitions and worry in GAD, panic disorder, social phobia, depression, and nonpatients. *Behavior Therapy*, 32(1), 85–102. DOI:10.1016/s0005-7894(01)80045-9
- Wells, A. & Cartwright – Hatton, S. (2004). A short form of the metacognition questionnaire: properties of the MCQ-30. *Behaviour Research and Therapy*, 42(4):385-96. DOI: 10.1016/s0005-7967(03)00147-5.
- Wells, A. & Papageorgiou, C. (1998). Relationships between worry, obsessive-compulsive symptoms and meta-cognitive beliefs. *Behaviour Research and Therapy*, 36(9), 899–913. DOI:10.1016/s0005-7967(98)00070-9.
- Zylowska, L., Ackerman, D. L., Yang, M. H., Futrell, J. L., Horton, N. L., Hale, T. S., Pataki, C. & Fuldner, S. L. (2008). Mindfulness meditation training in adults and adolescents with ADHD: a feasibility study. *Journal of Attention Disorders*, 11(6), 737-46. DOI: 10.1177/1087054707308502.