

Correspondence

Psychological Medicine, **43** (2013).

doi:10.1017/S0033291713001633

First published online 17 July 2013

Letter to the Editor

Multifaceted impairments of impulsivity in cannabis users?

With great interest, we read the article by Huddy *et al.* (2013) recently published by *Psychological Medicine*. The authors aimed to shed empirical light on the co-morbidity of first episode psychosis (FEP) and cannabis consumption with respect to two subdomains of impulsivity – response inhibition and reflection impulsivity. It was shown that patients with FEP had significantly greater impairment in response inhibition but not in reflection impulsivity compared to healthy controls. By contrast, patients with current cannabis use had greater reflection impulsivity but no impairments in response inhibition.

Over the past years an increasing number of studies have shown that impaired aspects of impulsivity like response inhibition are found across multiple substances with different pharmacological effects (Verdejo-Garcia *et al.* 2008; Solowij *et al.* 2012) and across several neuropsychiatric diseases (Fontanelle *et al.* 2011). In particular, there is a growing body of evidence for impaired impulsivity FEP on the one hand and complex associations of different aspects of impulsivity with cannabis consumption on the other. Interestingly, the study by Huddy *et al.* (2013) fails to show differences in response inhibition in cannabis users compared to drug-naïve and discontinued users. It was concluded that abnormal reflection impulsivity is associated with substance use in psychosis but not psychosis itself; the opposite relationship may hold for response inhibition.

The findings by Huddy *et al.* are in line with previous evidence of non-acute studies with different abstinence periods starting from 17 hours to more than a year. No impairments of cognitive inhibition among recreational (Griffith-Lendering *et al.* 2012) and long-term users (Pope *et al.* 2002) have been shown. Interestingly, performance of the Stroop task was affected by marijuana use only in individuals with lower cognitive reserves (Bolla *et al.* 2002) while cannabis users in another study did not differ significantly from controls, but were vulnerable to task complexity with increasing demands creating more sources of interference (Solowij *et al.* 2002). Moreno *et al.* (2012)

did find significantly different inhibitory control in recreational users with Stroop and Go/No-Go; and heavy users in Pope & Yurgelund-Todd (1996) exhibited more errors of inhibition than light users. In contrast, clear impairments among cannabis users of this aspect of impulsivity have been shown after acute administration (McDonald *et al.* 2003; Metrik *et al.* 2012).

While reflection inhibition in FEP in Huddy *et al.* (2013) is not significantly impaired compared to healthy controls, this is the case for cannabis users compared to non-users. Co-morbid continued usage in FEP shows earlier onset of psychosis and cannabis consumption, increased daily usage, more abuse of other drugs and tends to increase positive symptoms, interpretable as being more prone to jumping to conclusions. Reflection inhibition is a failure of pre-decisional information sampling and evaluation of situations (Solowij *et al.* 2012). Thus, it putatively influences decision making, which is impaired among acutely intoxicated cannabis users (Ramaekers *et al.* 2006; Vadhan *et al.* 2007) as well as after a time of abstinence (Griffith-Lendering *et al.* 2012; Moreno *et al.* 2012). However, whether impulsivity is the consequence of prolonged drug abuse or simply a personality trait leading to discontinuation difficulties, is still open to debate.

Although neuroimaging studies have provided compelling evidence for cannabis-related effects on brain structure and functioning (Martín-Santos *et al.* 2010), it still remains to be seen whether there are any specific effects on response inhibition. In conclusion, we suggest more studies like Huddy and colleagues (2013) as well as longitudinal and prospective designs are needed to investigate whether specific aspects of impulsivity could be considered neuropsychiatric endophenotypes of comorbid psychiatric disorders.

Declaration of Interest

None.

References

- Bolla KI, Brown K, Eldreth D, Tate K, Cadet JL (2002). Dose-related neurocognitive effects of marijuana use. *Neurology* **59**, 1337–1343.
- Fontanelle LF, Oostermeijer S, Harrison B, Pantelis C, Yücel M (2011). Obsessive-compulsive disorder, impulse control disorders and drug addiction. *Drugs* **71**, 827–840.
- Griffith-Lendering MF, Huijbregts SC, Vollebergh WA, Swaab H (2012). Motivational and cognitive inhibitory

- control in recreational cannabis users. *Journal of Clinical and Experimental Neuropsychology* **34**, 688–697.
- Huddy VC, Clark L, Harrison I, Ron MA, Moutoussis M, Barnes TRE, Joyce EM** (2013). Reflection impulsivity and response inhibition in first-episode psychosis: relationship to cannabis use. *Psychological Medicine*. Published online: 23 January 2013. doi:10.1017/S0033291712003054.
- Martín-Santos R, Fagundo AB, Crippa JA, Atakan Z, Bhattacharyya S, Allen P, Fusar-Poli P, Borgwardt S, Seal M, Busatto GF, McGuire P** (2010). Neuroimaging in cannabis use: a systematic review of the literature. *Psychological Medicine* **40**, 383–398.
- McDonald J, Schleifer L, Richards JB, de Wit H** (2003). Effects of THC on behavioral measures of impulsivity in humans. *Neuropsychopharmacology* **28**, 1356–1365.
- Metrik J, Kahler CW, Reynolds B, McGeary JE, Monti PM, Haney M, De Wit H, Rohsenow DJ** (2012). Balanced placebo design with marijuana: pharmacological and expectancy effects on impulsivity and risk taking. *Psychopharmacology (Berlin)* **223**, 489–499.
- Moreno M, Estevez AF, Zaldivar F, Montes JM, Gutierrez-Ferre VE, Esteban L, Sanchez Santed F, Flores P** (2012). Impulsivity differences in recreational cannabis users and binge drinkers in a university population. *Drug and Alcohol Dependence* **124**, 355–362.
- Pope Jr. HG, Gruber AJ, Hudson JL, Huestis MA, Yurgelund-Todd D** (2002). Cognitive measures in long-term cannabis users. *Journal of Clinical Pharmacology* **42**, 41–47.
- Pope Jr. HG, Yurgelund-Todd D** (1996). The residual cognitive effects of heavy marijuana use in college students. *Journal of the American Medical Association* **275**, 521–527.
- Ramaekers JG, Kauert G, van Ruitenbeek P, Theunissen EL, Schneider E, Moeller MR** (2006). High-potency marijuana impairs executive function and inhibitory motor control. *Trends in Cognitive Sciences* **31**, 2296–2303.
- Solowij N, Jones KA, Rozman ME, Davis SM, Ciarrochi J, Heaven PC, Pesa N, Lubman DI, Yücel M** (2012). Reflection impulsivity in adolescent cannabis users: a comparison with alcohol-using and non-substance-using adolescents. *Psychopharmacology (Berlin)* **219**, 575–586.
- Solowij N, Stephens R, Roffman RA, Babor T** (2002). Does marijuana use cause long-term cognitive deficits? *Journal of the American Medical Association* **287**, 2653–2654.
- Vadhan NP, Hart CL, van Gorp WG, Gunderson EW, Haney M, Foltin RW** (2007). Acute effects of smoked marijuana on decision making, as assessed by a modified gambling task, in experienced marijuana users. *Journal of Clinical and Experimental Neuropsychology* **29**, 357–364.
- Verdejo-Garcia A, Lawrence AJ, Clark L** (2008). Impulsivity as a vulnerability marker for substance-use disorders: Review of findings from high-risk research, problem gamblers and genetic association studies. *Neuroscience and Biobehavioral Reviews* **32**, 777–810.
- JOHANNES WREGE AND STEFAN BORGWARDT
Department of Psychiatry, University of Basel, Switzerland
- Author for correspondence: Stefan Borgwardt, Professor for Neuropsychiatry, Department of Psychiatry (UPK), University of Basel, c/o University Hospital, Petersgraben 4, 4031 Basel, Switzerland.
(Email: Stefan.Borgwardt@upkbs.ch)
- Psychological Medicine*, **43** (2013).
doi:10.1017/S0033291713001645

Letter to the Editor

Multifaceted impairments of impulsivity in cannabis users? – a reply

We are grateful to Wrege & Borgwardt (2013) for their interest in our article. We agree with their call for further studies that examine interaction between psychosis, cannabis use and impulsivity. As Wrege & Borgwardt (2013) note impulsivity is a multifaceted concept and consequently a diffuse array of measures has been developed to index it. This is reflected in the wide variability measures used in existing studies that focus on psychosis leading to few replications using the same measures. A large study, with a representative range of measures, would help identify the factor structure of the dimensions impulsivity in people with psychosis who are substance users *versus* non-users as a guide to future research. Meda *et al.* (2009) recently reported such a study in a non-psychotic sample, describing a five-factor solution that was similar in the substance-using and non-using populations. They reported differences between the groups only on reward sensitivity and self-reported impulsivity factors, with no differences on behavioural activation, temporal discounting or risk taking factors. It would be useful to determine if similar factors emerge in a sample of people with psychosis.

A model-building approach at the level of impulsivity could be complemented by further evaluating models of substance use in psychotic samples that incorporate impulsivity. One model (Blanchard *et al.* 2000) suggests that impulsivity interacts with daily stress to exacerbate substance use in psychosis. At the time this model was put forward there was no obvious methodology available to test it. More recent work on the Experience Sampling Method (Myin-Germys *et al.* 2009) has provided a technique