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Informationally administered reward enhances intrinsic motivation in schizophrenia

Hyeon-Seung Lee[a], Seon-Kyeong Jang[a], Ga-Young Lee[a], Seon-Cheol Park[b], Alice Medalia[c], Kee-Hong Choi[a,*]

[a] Department of Psychology, Korea University, Liberal Arts Building, Sungbuk-Ku, Anam-Dong, Seoul 136-701, Republic of Korea
[b] Department of Psychiatry, Inje University College of Medicine and Haeundae Paik Hospital, Busan, South Korea
[c] Department of Psychiatry, Columbia University Medical Center, New York, NY, USA

A R T I C L E I N F O

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A B S T R A C T

Even when individuals with schizophrenia have an intact ability to enjoy rewarding moments, the means to assist them to translate rewarding experiences into goal-directed behaviors is unclear. The present study sought to determine whether informationally administered rewards enhance intrinsic motivation to foster goal-directed behaviors in individuals with schizophrenia (SZ) and healthy controls (HCs). Eighty-four participants (SZ = 43, HCs = 41) were randomly assigned to conditions involving either a performance-contingent reward with an informationally administered reward or a task-contingent reward with no feedback. Participants were asked to play two cognitive games of equalized difficulty. Accuracy, self-reported intrinsic motivation, free-choice intrinsic motivation (i.e., game play during a free-choice observation period), and perceived competency were measured. Intrinsic motivation and perceived competency in the cognitive games were similar between the two participant groups. The informationally administered reward significantly enhanced self-reported intrinsic motivation and perceived competency in both the groups. The likelihood that individuals with schizophrenia would play the game during the free-choice observation period was four times greater in the informationally administered reward condition than that in the no-feedback condition. Our findings suggest that, in the context of cognitive remediation, individuals with schizophrenia would benefit from informationally administered rewards.

1. Introduction

Motivation is crucial in learning and functional outcomes in individuals with schizophrenia (SZ) (Choi and Medalia, 2010; Medalia and Saperstein, 2011). A recovery-oriented paradigm in psychiatric rehabilitation including cognitive remediation highlights an active role of the client in his or her care, their greater sense of agency, and motivation for care (Davidson et al., 2007). As the paradigm indicates, intrinsic (IM) and extrinsic motivation (EM) play a vital role in psychiatric rehabilitation (Medalia and Brekke, 2010; Medalia and Saperstein, 2011; Silverstein, 2010). It has been proposed that EM involves motivation due to a separate external outcome, whereas IM involves inherent pleasure associated with an activity without a tangible reward (Barch, 2005; Ryan and Deci, 2000). Both IM and EM are therapeutically necessary for tailoring treatment approaches according to individual needs and desires (Medalia and Brekke, 2010).

Interestingly, IM and EM were advantageous for SZ with severe cognitive deficit or low baseline IM in most treatment settings; SZ could benefit from EM, IM, or both (Silverstein, 2010). In relation to this, one study argued that the successful use of IM and EM depends on the treatment context and motivator type—for example, monetary reward (EM) is important in supportive employment settings but is likely to be unimportant in learning situations such as supportive education, cognitive remediation, and CBT for psychosis (Medalia and Saperstein, 2011).

More importantly, it has been consistently reported that SZ show a malleable ability to respond to motivation-enhancing strategies (Choi et al., 2013; Choi and Medalia, 2005, 2010; Medalia and Brekke, 2010; Nakagami et al., 2010). Targeting IM directly has been found to be a viable and effective treatment for SZ. For instance, Choi and Medalia (2010) incorporated three IM-enhancing components (e.g., offering choice) into learning materials, and their IM manipulations successfully enhanced motivation and cognitive learning. Most recently, Fiszdon et al. (2016) investigated the effect of motivational interviewing in

* Corresponding author.
E-mail address: keehongchoi@gmail.com (K.-H. Choi).

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cognitive rehabilitation. Although the intervention was brief (2 sessions), task-specific motivation and training attendance were significantly higher in the motivational interviewing condition.

However, due to several reasons, there is lack of clarity on the means through which IM is enhanced in SZ in treatment settings that use external reward, and how IM and EM generalize to behavioral initiation and goal attainment (Barch, 2008). First, findings regarding IM and EM's effects on recovery outcomes are mixed. Although EM has been found to assist SZ in improving their behavioral and cognitive outcomes (Silverstein, 2010), other studies have reported that EM alone did not improve cognitive performance (Bellack et al., 1990; Green et al., 1992; Hellman et al., 1998). Moreover, an undermining effect of EM on IM was reported in healthy controls (HCs) (Ryan et al., 1983). This effect was replicated behaviorally and neurally (Deci et al., 2001; Murayama et al., 2010), thus confounding which kind of (and how much) motivation affects behavior.

The undermining effect of EM is contingent on EM delivery conditions and type of motivator in healthy students. Ryan et al. (1983) reported that either task contingent or performance contingent reward could show an undermining effect on IM, complying with the reward administration context — for example, the higher the instrumentality (or lesser the degree of control) conveyed by the reward, the more IM is undermined. However, if the reward is informationally administered (more saliently in performance contingent reward with positive feedback), the reward enhances self-reported IM for a cognitive game and promotes game play during a free-choice observation period (Ryan et al., 1983). Similarly, a meta-analysis (Deci et al., 2001) showed that the manner of teachers' feedback delivery significantly moderated the impact of the feedback, which was perceived as controlling; in addition, it decreased IM because it was considered to diminish self-determination and autonomy. Given the increasing interest in clinician-provided cognitive remediation (Medalia et al., 2015), it is important to consider the effect of reward facilitators on IM.

No studies have been conducted to determine whether an informationally administered reward (i.e., informational feedback) can enhance IM in a cognitive game context. Therefore, we sought to determine whether an informationally administered reward enhanced self-reported and free-choice IM for cognitive games in SZ and HC.

2. Materials and methods

2.1. Participants

Forty-three SZ (17 long-term inpatients and 26 outpatients from a community psychiatric rehabilitation center) and 41 HC from the community were recruited as participants (Table 1). Psychiatrists administered a structured clinical interview to identify Axis I disorders based on the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition Axis I disorders (First et al., 2005). This verified the schizophrenia diagnosis and confirmed that the HC were a nonclinical sample. All patients were required to take antipsychotic medication (mean chlorpromazine equivalent = 600.38). HC were aged 20–55 years, with no history of psychiatric illness, sensory deficits, or neurological diseases, which was confirmed in the screening interview. Demographic (including cigarette smoking) and neurocognitive factors were also investigated in order to control for confounding variables that could affect motivation in SZ. All the participants provided written informed consent prior to assessment. After assessment, the participants were randomly assigned to either the informationally administered reward condition or the no-feedback condition. The local institutional review boards approved the study (KU-IRB-13–114-A-1-(E-*P*-1)).

2.2. Measures

2.2.1. The Positive and Negative Syndrome Scale

The Positive and Negative Syndrome Scale (PANSS; Kay et al., 1987) is a well-developed instrument that assesses the severity of positive and negative symptoms of schizophrenia. The five-factor model is strongly reliable, variable, and sensitive (Emsley et al., 2003; Fresán et al., 2005; Lindenmayer et al., 1995; Lykouras et al., 2000; White et al., 1997). The model proposed by Wallwork et al. (2012) was used in this study. The Cronbach's αs for each factor were as follows: Positive = 0.74, Negative = 0.88, Disorganized = 0.75, Excited = 0.85, and Depressed = 0.65. The inter-rater reliability of the scale was high (α = 0.91).

2.2.2. The Intrinsic Motivation Inventory for Schizophrenia Research – Interest/Enjoyment

The Interest/Enjoyment subscale of the Intrinsic Motivation Inventory for Schizophrenia Research (IMI-SR; Choi et al., 2009) was used to measure self-reported intrinsic motivation for cognitive game playing. This subscale contains seven items rated using a seven-point Likert scale (1 = not at all true, 7 = very true). Higher scores indicate higher interest and enjoyment. The original scale showed good internal consistency (α = 0.95) and acceptable test-retest reliability (r = 0.74). The Korean version of the Interest/Enjoyment subscale showed good internal reliability (α = 0.91).

2.2.3. The Perceived Competence Scale

Perceived competency in cognitive games was assessed using the Perceived Competence Scale (PCS; Deci et al., 1981), which was based on Harter's (1981) original self-report scale and was adapted for SZ adults. The PCS consists of four items rated on a seven-point Likert-scale (1 = not at all true, 7 = very true). The Korean PCS showed good internal reliability (α = 0.87).

2.3. Neurocognitive tasks

2.3.1. The Trail Making Test

The Trail Making Test (TMT) consists of two parts that measure simple attention (TMT-A) and set-shifting ability (TMT-B) (TMT-B; Reitan, 1958). In Part A, participants draw lines connecting 25 circles numbered in an ascending order. In Part B, participants connect 25 distributed circles alternating between numbers and letters arranged in an ascending order. Participants are instructed to connect circles as quickly as possible, within 90 s in TMT-A, and within 300 s in TMT-B. Longer completion time indicates poorer cognitive functioning.

2.3.2. The verbal fluency task

Participants uttered as many words as possible from a given category within 1 min. Production of more words indicated better cognitive flexibility and frontal lobe function (Fossati et al., 1999). Performance on a verbal fluency task has been related to psychomotor speed in schizophrenia. In the present study, participants were instructed to utter words from the category "animal" as suggested by van Beilen et al. (2004).

2.3.3. The coding subtest of the Korean Wechsler Adult Intelligence Scale

The Coding subtest of the Wechsler Adult Intelligence Scale, Fourth Edition (K-WAIS-IV), in which participants are required to copy symbols paired with numbers for 2 min, was used to assess processing speed (Wechsler, 2008a, 2008b). The scale reflects short-term visual memory, visual-motor coordination, and processing speed. A higher number of copied symbols indicate better cognitive functioning.

2.3.4. The information subtest of the Korean Wechsler Adult Intelligence Scale

The Information subtest of the K-WAIS-IV, which probes general knowledge and indicates the extent of general information acquired during one's lifetime, was used to estimate premorbid IQ. The following formula (developed and validated on a Korean population) was used: 67.173 + 1.722 * (information) + 0.161 * (age) + 0.995 * (years of education; Kim et al., 2015).