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LETTERS TO THE EDITOR

Ultimatum game in recovered schizophrenia patients: preliminary findings

The Ultimatum Game (UG) is a two-person game used in neuroeconomics studies. Two players are allotted a sum of money. The first player, called 'the proposer,' offers a portion of the money to the second player, called 'the responder.' If the responder accepts the offer, both players split the money, as proposed. In contrast, if the responder rejects the offer, both players receive nothing. If the responder wishes to maximize their income, they should accept any positive offer. However, previous studies have shown that relatively small offers have high rates of rejection.[1] These findings suggest that fairness and emotion play important roles in the game. The influence of the depressive state on socioeconomic decisions is an important research question. Ecologically valid social decision-making paradigms, including UGs, may aid the identification of suboptimal choices associated with recovered schizophrenia patients. Patients with chronic schizophrenia seem to have some understanding of rules of social exchange including fairness, because no significant correlations emerged between symptom severity and task performance.[2] However, it remains unknown whether patients with recovered schizophrenia were disturbed in the ability of understanding of rules of social exchange. The aim of the present study was to investigate the differences in decision-making using the UG in recovered schizophrenia patients and healthy controls. A total of 57 individuals participated in our study: 27 patients (male/female: 12/15, age: 41.3±11.0 years) met the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition criteria for schizophrenia and our operational definition of recovery. Recovery from schizophrenia was defined as 1) meeting the criteria put forth by Lieberman et al.[3] 2) a clinical global impression of improvement score of ≤2 before receiving antipsychotics, and 3) no tolerability problems or compliance issues. The average score of the Brief Psychiatric Rating Scale[4] was 32.6±5.3. The average dose of antipsychotic drugs was 337.6±183.7 mg/day (CPZ-eq). Thirty sex- and age-matched healthy volunteers (male/female: 11/19, age: 37.1±12.5 years) were recruited for comparison. This study was approved by the appropriate Ethics Committee in University of Occupational and Environmental Health, Japan. Written informed consent was obtained from all the participants. The subjects acted as responders in a series of 22 trials of the Ultimatum Game. In each trial, the participant had an offer to split a hypothetical 1000 yen. Each offer was chosen from five types of splitting; 500-500, 600-400, 700-300, 800-200, 900-100. Then, the screen showed the message "Accept or Reject?" to the participant. After considering the offer, the participant pushed a button ("Accept" or "Reject"). Last, the participant saw the outcome based on his/her response. Before beginning the test, the subjects were informed that the proposer was also a participant in this study and was connected via the Internet to a computer in a different room. It was explained to the subjects that the proposer was free to decide how to split the money, but the subject could choose whether to accept the offer (resulting in a payout for both players) or reject the offer (resulting in $0 for both). Also, the subjects were instructed to obtain as much amount as possible.

In fact, the proposer worked together with the experimenter, and the offers were predetermined by the experimenter (2 offers of 500-500, 2 offers of 600-400, 6 offers of 700-300, 6 offers of 800-200, and 6 offers of 900-100).

The rejection rates did not significantly differ between the schizophrenia recovery group and the healthy control group (Fig. 1). In addition, there were no significant differences in the total amounts of money obtained between the two groups (3163.0±1639.7 vs. 2924.1±1285.8 yen). Limited studies have used the UG to assess patients with schizophrenia. In one study, patients with schizophrenia were more likely than healthy individuals to accept more unfair offers.[5] Another study showed that patients with schizophrenia are prone to avoid responses to unfair proposals.[6] The findings were controversial, which may be related to the heterogeneity and/or stage of schizophrenia. Unfair offers are mainly related to anterior insula, and dorsolateral prefrontal cortex that sustained emotion and cognition including decision making,[7] which was reported to decrease the cortical volume.[8] In addition, Csukly et al.[9] reported schizophrenia patients were impaired in socioeconomic interactions requiring emotion recognition and decision-making, which might result in unstable behavioral strategies. Yang et al.[10] also reported that schizophrenia patients exhibited impaired social decision-making. The impairment could be partially explained by their deficits of theory of mind rather than neurocognitive disturbance. Patil et al.[11] showed aberrant social decision-making and increased inequity aversion in

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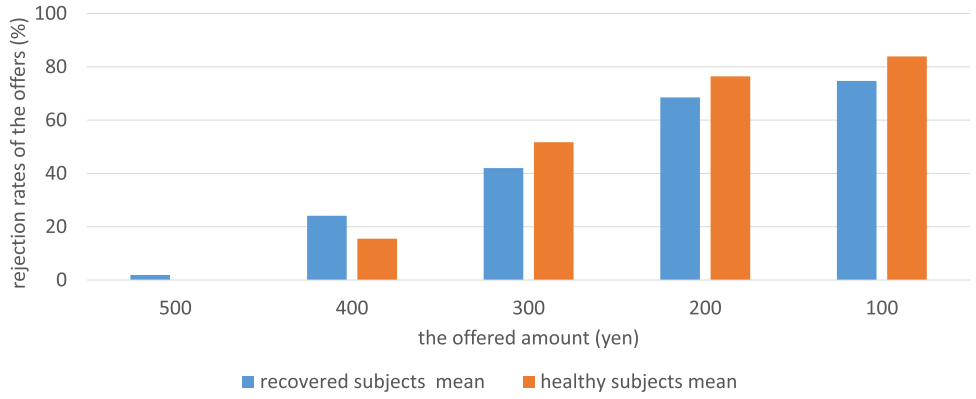

Figure 1 Rejection rate of the Ultimatum Game between the recovered schizophrenia group and the healthy control group.

schizophrenia. To the best of our knowledge, this is the first study to investigate decision-making using the UG in recovered schizophrenia patients. The results of the present study indicate that decision-making accompanied by fairness and emotion does not differ between recovered schizophrenia patients and healthy controls. Further studies with larger samples and considering confounding factors associated with decision-making should be conducted.

Ethics approval and consent to participate

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