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## The relationship of cognitive improvement after cognitive remediation with social functioning in patients with schizophrenia and severe cognitive deficits

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### ABSTRACT

**Background:** This study aims to examine the effects of change in neurocognition on functional outcomes and to examine predictors of change in social functions following a 12-week course of cognitive remediation in patients with schizophrenia and schizoaffective disorder with severe cognitive impairments.

**Method:** Level of social functioning was assessed using a performance based measure of functional capacity (PSP) in patients prior to and after the completion of 12-week cognitive remediation treatment (CRT). Participants completed a neuropsychological battery (MCCB-MATRICES) and clinical measures at both time points.

**Results:** 63 subjects with a mean age of 41.4 (SD = 12.2) and with 12.2 years of education (SD = 2.4) were enrolled. There were significant improvements in overall PSP score from baseline to endpoint ( $p = 0.021$ ) as well as in PSP domain A (socially useful activities) ( $p \leq 0.001$ ), domain B (personal and social relationships) ( $p = 0.009$ ), and domain D (disturbing and aggressive behaviors) ( $p = 0.003$ ). There was a significant improvement in the composite MCCB score ( $p = 0.020$ ) and the Working Memory ( $p < 0.046$ ). Stepwise logistic regression yielded a significant association for baseline Visual Learning (Wald = 6.537,  $p = 0.011$ , OR = 1.195), Speed of Processing (Wald = 4.112,  $p = 0.043$ , OR = 0.850) and level of PANSS positive symptoms (Wald = 4.087,  $p = 0.043$ , OR = 0.739) with PSP overall improvement.

**Conclusions:** Faster speed of processing, better visual and verbal learning and less prominent positive symptoms were associated with greater functional improvement after a systematic cognitive intervention within a rehabilitative setting.

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### 1. Introduction

Deficits in cognition are well established in patients with schizophrenia (Bilder et al., 2000; Elevag and Goldberg, 2000; Harvey et al., 2005). Specifically, impairments in attention (Cornblatt and Kelip, 1994), working memory, verbal fluency, visual learning, and processing speed have consistently been reported (Bilder et al., 2000; Bowie and Harvey, 2006; Goldman-Rakic, 1994). Furthermore, deficits in social cognition, such as Theory of Mind (ToM) and facial emotion recognition,

have also been observed (Brüne, 2005; Kohler et al., 2003). Cognitive and social functions play a major role in community adjustment. In particular, executive functioning, verbal memory, speed of processing, and social cognition have been found to have a strong effect on overall functioning in patients with schizophrenia (Green, 1996; Green et al., 2000; McGurk and Meltzer, 2000; Bowie and Harvey, 2006; Lindenmayer et al., 2013; Torio et al., 2014). Hence, cognitive and social functions have emerged as an important treatment target in schizophrenia. One such treatment is cognitive remediation (CRT), which has been shown in a number of meta-analyses to have moderate to large effects on cognitive outcomes (McGurk et al., 2007; Wykes et al., 2011).

A less explored question is the potential effects of CRT on social functions. Given the role of neurocognitive functioning in supporting social cognitive functioning, it is plausible that gains in neurocognitive functioning occurring during CRT would contribute to improved social functions. The goal of the current study was to first investigate the

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relationship of the effects of neurocognitive improvement following CRT on overall functioning in patients with chronic schizophrenia and schizoaffective disorder and severe cognitive impairments. We hypothesized that improvements in cognitive functions following CRT may lead to improvements in social functioning. Secondly, we were interested to assess which baseline cognitive domains and clinical attributes predict change in social functioning after CRT.

## 2. Experimental material and methods

This study was part of a parent study comparing the effectiveness of two CRT interventions supplemented with a social cognition training program for patients with chronic schizophrenia. Inpatients and outpatients with a DSM-IV-TR diagnosis of schizophrenia or schizoaffective disorder were consecutively enrolled from the parent study. Inpatient subjects were clinically stable and awaiting placement into a community residence. All subjects were participating in concomitant standardized rehabilitation programs, which included weekly psycho-educational groups about mental illness, coping skills, understanding medications and symptoms. The protocol was approved by the local IRB (Nathan S. Kline Institute for Psychiatric Research) and all subjects signed an informed consent.

Inclusion criteria: (1) Age 18–55 years; (2) Inpatients or outpatients; (3) DSM-IV-TR schizophrenia or schizoaffective disorder, with illness duration  $\geq 5$  years; (4) Auditory and visual acuity adequate to complete cognitive tests; (5) Stable dose of atypical antipsychotic medication for at least 4 weeks prior to enrollment; (6) Good physical health determined by physical examination and laboratory tests; (7) Capacity and willingness to give written informed consent; (8) at least an 8th grade reading level as evidenced from psychological assessment during the chart review or the Wide-Range Achievement Test–Third Edition (WRAT-3) (Wilkinson, 1993).

Exclusion Criteria: (1) Inability to read or speak English; (2) Documented disease of the central nervous system; (3) History of intellectual disability pre-dating onset of symptoms of psychosis; (4) Clinically significant cardiovascular, renal, hepatic, gastrointestinal, pulmonary or hematologic conditions; (5) HIV + status.

Subjects underwent 36 sessions of CRT in one of two cognitive remediation programs, COGPACK (Marker and Olbrich, 1998) or Posit Science (San Francisco, California) with or without an additional social cognition program (SCT). Hence, subjects were randomized to one of four cognitive remediation treatment programs: (1) COGPACK alone, (2) COGPACK + Mind Reader: An Interactive Guide to Emotions (Baron-Cohen et al., 2004), (3) Posit Science alone, or (4) Posit Science + Mind Reader: An Interactive Guide to Emotions (see Fig. 1). Each session was approximately one hour long and occurred three times a week (2 CRT sessions and one SCT session). Subjects, who were not randomized to the Mind Reader program, received a weekly session of writing exercises for 12 weeks to control for the missing MindReading session. All subjects took part in an additional hour long curriculum-based discussion group that focused on the application of cognitive skills to everyday functioning, called the “Thinking Skills for Living” groups (Lindenmayer et al., 2008; McGurk et al., 2007). CRT treatment groups were facilitated by at least two trained staff members who were psychologists, psychology interns, or master's level psychology students, supervised by PhD level neurocognitive specialists with >10 years' experience in neurocognitive assessment and interventions with the subject population.

At baseline and endpoint, subjects underwent assessments of cognition, functioning and psychopathology. Raters were trained by a senior psychometrician (AK) and were kept blind as to the treatment assignment.

The MATRICS Consensus Cognitive Battery (MCCB) was administered to measure cognition. It is composed of ten tests that target seven cognitive functioning domains: speed of processing, attention/vigilance, working memory, verbal learning, visual learning, reasoning and problem solving, and social cognition. The scores of these domains are combined to give an overall composite score (Nuechterlein et al., 2008).

The Personal and Social Performance Scale (PSP) was created on the basis of the social functioning component of the DSM-IV Social and Occupational functioning Assessment Scale (SOFAS) to assess social functioning in schizophrenia. The PSP scale is a validated clinician-related scale that measures personal and social functioning in the domains of

## Study Flow Diagram

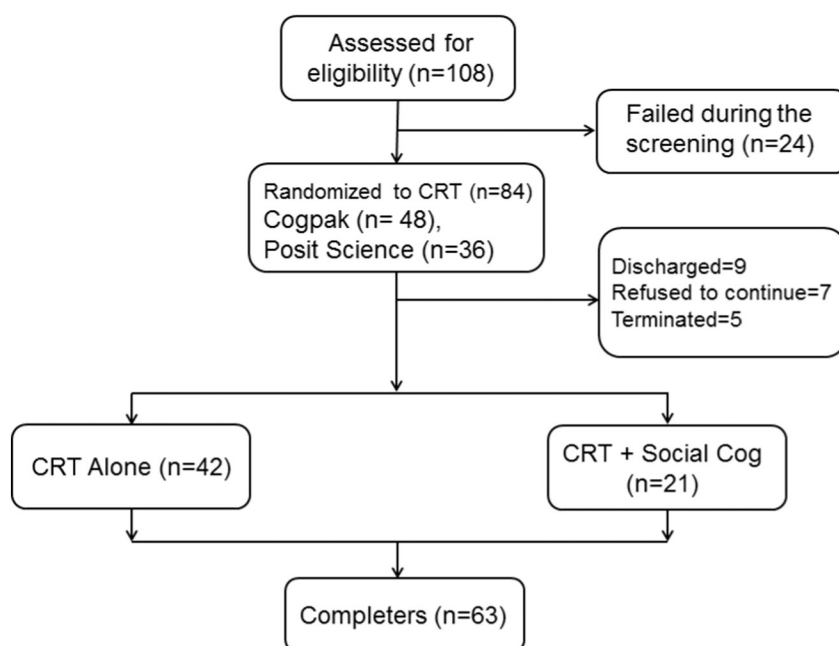


Fig. 1. Patient disposition and study flow diagram.

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