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Generalization of cognitive training in an Australian sample of schizophrenia patients

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Abstract

Objective: The present study was undertaken to evaluate the effect of cognitive training in improving trained and untrained cognitive processes in schizophrenia.
Methods: A simple pre- and post experimental study with a three month follow-up was conducted to determine the efficacy of cognitive training in speed of processing and executive functions improving cognition in 22 schizophrenia patients.
Results: Significant improvement was found in those cognitive domains specifically targeted in the training protocol, but also to a limited extent on verbal memory and social cognition. There was also evidence of improvements in symptoms and social functioning. The training effects failed to transfer to community functioning skills however. Except for social cognition, these improvements were maintained at 3 month follow-up.
Conclusion: The study highlights the importance of understanding the mechanisms that contribute to the transfer of skills as well as the maintenance of cognitive changes in individuals with schizophrenia.

1. Introduction

It is now generally recognised that cognitive deficits are the core components of the disorder of schizophrenia [1], a strong predictor for functional outcomes and pose significant challenges for effective and successful rehabilitation and psychopharmacological management [2].

Numerous studies have been conducted to identify the fundamental deficit in schizophrenia and this has led to seven cognitive domains being identified for intensive research and targeting for remediation [3,4]. Among the seven cognitive deficits identified, memory, specifically verbal memory and learning, have often been reported to be the most prominent deficit [5] in schizophrenia. Findings from meta-analysis claimed that although a severe deficit was indicated in verbal memory and learning areas with an effect size of 1.41, deficits in executive function (0.88) and attention function (1.16), were also present [6]. However, a recent review has recently argued that the memory deficits seen in schizophrenia patients more closely resemble the deficits exhibited by patients with lesions to the prefrontal cortex (PFC) (or patients with disorders involving frontrostriatal pathology) rather than the amnestic syndromes evident in patients with lesions to the medial temporal lobe (MTL) [7]. They, therefore, propose that abilities other than the capacity to encode and consolidate a memorial representation of previous events could underpin the memory deficits observed in schizophrenia patients;

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specifically, that the well established deficits in executive functions and control processes could result in less effective encoding and retrieval of episodic information in patients. This cognitive control process governs and regulates information, and inhibits irrelevant information during encoding processes as well during information retrieval [7]. Other researchers have also noted that a core deficit in executive functions and attention control processes may underpin all other cognitive deficits in patients, including verbal memory deficits [8,9]. However, there is also evidence from a recent meta-analysis that processing speed deficits are a central feature of the cognitive deficit in schizophrenia [10,11]. Furthermore, processing speed deficits not only account for most of the differences in cognition between patients with schizophrenia and controls [12,13] but they are also a central factor in mediating the relationship between cognitive deficits (including verbal memory deficits) and functional outcomes in schizophrenia.

However, there is no reliable and consistent evidence about which cognitive process is the core deficit in schizophrenia and therefore little guidance on targeting the right cognitive process for effective intervention. Despite this, for a number of cognitive training regimes that have been used, enhancement has been shown on both global [14] as well as specific targeted cognitive processes, including verbal and visual memory [15,16]; executive function [17–19]; attention [20,21]; facial affect recognition [22–24]; and processing speed and working memory [25]. Effect sizes derived from meta-analysis show that the effectiveness of cognitive training in improving cognition and community functioning are greater when the training was combined with other psychosocial rehabilitation (ES = 0.71) [26]. However, there are insufficient data on whether training effects transfer to untrained tasks, as well as how long the training effects on cognition are maintained [27].

Of particular relevance to the current research, there are limited studies to date, which show whether training of non-memory abilities changes memory functioning. Hence, the rationale of the present study is to test specifically whether training of processing speed and control processes (executive functions and attention) improves performance not only on the trained tasks but also on the untrained tasks, focussing on the areas of verbal memory and learning, as well as psychosocial functioning and symptoms. It is hypothesised that there will be a significant improvement in specific cognitive skills and psychosocial functioning and a reduction in symptoms following training, and that these improvements will still be maintained at the three month follow-up.

2. Methods

2.1. Recruitment of participants

This study which consisted of two parts, aimed to evaluate the efficacy of cognitive training via neuropsychological and electrophysiological indices. The present work considered the neuropsychological data from the first part of the study, while the electrophysiological indices of the second part are planned to be reported in a future publication. Initially, participants were recruited only from the Maitland Community Based Outpatient Clinic, located in a rural area in the Lower Hunter region of New South Wales, Australia. Due to a poor response and geographical and logistical problems that posed difficulties for effective recruitment, it was necessary to modify the study design. In order to increase the sample size, assistance was sought from the Australian Schizophrenia Research Bank (ASRB) of patient volunteers [28] and recruitment was extended to other Hunter regions. Volunteers were also sought via advertisements in the local media, flyers, direct mail, phone contact through case managers, as well as presentations to case managers. The study was approved by Hunter New England Area Health Ethics Committee and the University of Newcastle Human Research Ethics Committee. Data were gathered from these sources at various time points, beginning in October 2009 and ending in December 2010, with treatment sessions and follow-up assessments continuing until the end of June 2011.

2.2. Participants

Twenty-six participants volunteered to participate in the study during the baseline phase. Two participants withdrew from the study during the training stage due to the training program, not meeting their expectations (n = 1), or poor tolerance of training tasks and family problems (n = 1). One participant did not provide post treatment data due to an exacerbation of symptoms, while one withdrew prior to attending the follow-up assessment due to loss of interest. A total of 22 participants completed the study. All participants were provided with detailed information about the study and gave written consent to participate. The study was approved by Hunter New England Area Health Ethics Committee and the University of Newcastle Human Research Ethics Committee.

The 22 participants, whose data are being reported, had a diagnosis of either schizophrenia or a schizoaffective disorder. Screening excluded individuals having a neurological disorder or head injury; an IQ below 75 based on a standardised intelligence test; current substance abuse; colour blindness; hearing thresholds more than 20 dB above the normal range; or uncorrected visual impairments. Due to the complexity of participant recruitment [28,29], consensus diagnoses were either based on Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria or the Diagnostic Interview for Psychosis (DIP) [30], as well as information gathered from case notes and case managers.

Sixty-four percent of the patients were male. Their mean age was 36.7 (range 18–55) years. Mean pre-morbid IQ of the patient sample was estimated to be 35.52 (SD = 9.7 range 16–49) from WTAR administered at baseline. Most of the participants were symptomatic but stable at the time of entry into the protocol, while 46% of participants had been