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Effectiveness of cognitive skills training in schizophrenia

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Summary

Background and aim*: Cognitive impairments are widely acknowledged as a central feature of schizophrenic disorders. The present study evaluated the effects of cognitive skills training in a sample of schizophrenic outpatients.*

Material and methods*: Fourteen subjects in the experimental group received 12 sessions of practice skills with various cognitive tasks, while 19 patients in the control group participated in sessions involving psychoeducation only.*

Results*: The analysis of treatment effects indicated that patients from the experimental group improved their performance in all cognitive tests and enhanced some aspects of illness awareness. Patients in the control group improved in their overall symptom score and in all insight scores.*

Conclusion*: A brief course of cognitive training can be sufficient to improve cognition in patients with schizophrenia. However, the generalizability of this effect on illness awareness and symptomatology is less tangible.*

Key words: schizophrenia, cognitive rehabilitation, insight

Cognitive impairments are widely acknowledged as central feature of schizophrenic disorders. In the past decade schizophrenia has become the target of many rehabilitation programmes. Several studies have yielded promising results, for example Medalia et al. [1] demonstrated that schizophrenic patients receiving computerized attention training made significantly more improvements than the control group. Patients participating in the training became more vigilant and less distractible, moreover, these effects further generalized to severity of their symptomatology. In another successful programme, Bellack et al. [2] trained two groups of patients on two different neurocognitive tasks. Both groups showed large improvements on the tests in which they were trained and only moderate improvement on the untrained test, while a control group failed to exhibit improvement on either test. Similarly, in Wexler et al.'s [3] study most patients practicing sustained perceptual, memory and motor tasks achieved performance levels equal to or greater than high functioning healthy control subjects.

However, there is also much skepticism concerning the effects of direct remediation of cognitive deficits in schizophrenia, especially their generalisability and durability [cf. 4, 5]. In recent meta-analysis of several randomised controlled trials, Pilling et al. [6] have concluded that cognitive remediation does not appear to give reliable benefits for patients with schizophrenia. Similarly, Suslow et al. [7] in their review of literature have drawn the inference that there is weak evidence that attentional training is effective in schizophrenia. Nevertheless, cognitive deficit(s) remain one of the most important targets of rehabilitation in schizophrenia. Studies searching for successful rehabilitative methods are still in progress.

Many research findings have demonstrated that cognitive impairments are associated with the level of social competence in schizophrenic patients [eg., 8, 9, 10], they limit the rate of improvement in work rehabilitation [11, 12, 13] and the ability to gain from social skills training interventions [8, 14]. The literature is less consistent concerning the relationships between cognitive impairments and schizophrenic symptoms. However, recent meta-analyses have supported the hypotheses that executive functioning and sustained attention are related to negative, but not positive symptoms [15], and verbal memory is related to negative and disorganisation symptoms, but not to hallucinations and delusions [16]. Most of the conceptual and methodological problems in studying relation of cognitive impairment to clinical symptoms arise from the marked heterogeneity of diagnostic group of the schizophrenic disorder [cf. 17, 18, 19]. In order to understand this heterogeneity better, various classifications of schizophrenic symptoms have been developed. The most influential one has categorised symptoms into positive and negative syndromes [20]. However, it seems that research based on this dichotomy has yet to establish a satisfying pattern of relationships between schizophrenic psychopathology and cognitive impairments [21, 22, 23]. With the hope of overcoming inconsistencies, recent studies have begun to explore relationships between cognitive deficits and symptoms segregated into three syndromes, namely: reality distortion, psychomotor poverty and disorganization [24, 25], or additional syndromes [e.g., 26, 27, 28; cf. 29, 30, 31, 32, 33, 34, 35]. This new approach in studying schizophrenic symptoms was used in a study presented in this paper.

The lack of awareness of illness has been regarded as a crucial factor in schizophrenia by many clinicians and researchers. It is assumed to have deleterious effects on treatment compliance and prognosis [36, 37, 38]. Studies that tested whether unawareness of mental disorder in schizophrenia is related to cognitive deficits have yielded inconsistent results. A number of reports have found no relationship between insight and performance on cognitive tests [39, 40, 41, 42, 43, 44]. Several authors have proposed a hypothesis, that lack of insight results from the psychotic disease process itself and could be considered a primary and separate symptom domain [39, 41, 45]. In contrast, other studies have shown significant links between poor insight and cognitive deficits, especially between insight and executive functions measured by Wisconsin Card Sorting Test [46, 47, 48, 49, 50, 51]. These discrepancies in results may be partly explained by the hypothesis that cognitive deficits are relevant to insight only in samples of more chronic patients with marked cognitive deterioration [39, 40], the group of patients targeted also in our study. Simultaneous improvement

both in cognitive functioning and in illness awareness would support the hypothesis about the relationship between them.

The first aim of this study was to investigate effectiveness of a method of cognitive training on main cognitive functions affected in schizophrenia, namely verbal memory/ learning, visual-spatial processing, psychomotor speed/attention, and verbal fluency. The method applied was studied in an earlier pilot study and suggested that patients could benefit from this training [52]. The second aim was to compare the cognitive training and psychoeducational intervention in their influence on various aspects of insight and main components of schizophrenic symptomatology.

Subjects and methods

Patients

All the participants were treated at the Community Psychiatry Unit at the Institute of Psychiatry and Neurology in Warsaw. Patients were included if they: 1) declared motivation to participate in the study, 2) were diagnosed as suffering from schizophrenia spectrum disorders (according to ICD-10 criteria [53]), 3) were receiving antipsychotic medication at fixed doses, 4) were under the age of sixty. Moreover, no subject with a history of previous electroconvulsive therapy, evidence of organic brain syndrome or mental retardation was included in the study. The persons included mostly represented chronic patients who have a history of many hospitalizations. Most patients were receiving atypical neuroleptics in a standard therapeutic range. For demographic and clinical characteristics of examined groups see Table 1.

Table 1

Characteristics of examined groups

	Experimental group (n = 14)	Control group (n = 19)
Age (years) - Mean (S.D.)	44.4 (9.7)	43.6 (7.9)
Gender (n): Female / Male	5 / 9	9 / 10
Level of education (n): Elementary / Technical / Secondary / University	3 / 2 / 7 / 2	3 / 4 / 8 / 4
ICD-10 Diagnosis (n): Schizophrenia / Schizoaffective / Persistent delusional disorder	13 / 0 / 1	15 / 3 / 1
Duration of illness (years) - Mean (S.D.)	19.1 (10.3)	17.3 (7.0)
Patients on typical / atypical neuroleptic medication (n)	4 / 10	8 / 11

Symptom and insight measures

All patients were rated on a 30-item clinical scale, the Positive and Negative Syndrome Scale (PANSS) [54]. In this project we segregated symptoms into five dimensions delineated by Kawasaki et al. [27]. Using principal component analysis they disclosed five orthogonal independent symptom groups: 1) negative (PANSS: Blunted affect,

Emotional withdrawal, Poor rapport, Passive/apathetic social withdrawal, Lack of spontaneity and flow of conversation, Stereotyped thinking, Mannerisms and posturing, Motor retardation, Disturbance of volition); 2) hostile/excited (Excitement, Grandiosity, Suspiciousness/persecution, Hostility, Anxiety, Tension, Uncooperativeness, Poor impulse control, Active social avoidance); 3) thought-disordered (Conceptual disorganisation, Difficulty in abstract thinking, Disorientation, Poor attention, Lack of judgment and insight); 4) delusional/hallucinatory (Delusions, Hallucinatory behaviour, Unusual thought content, Preoccupation) and 5) depressive (Guilt feelings, Depression) components.

The Scale to Assess Unawareness of Mental Disorder (SUMD), developed by Amador and Strauss [55], was used to assess patients' insight into psychosis. The scale samples discrete and global aspects of insight which follows recent conceptualizations of insight as a multidimensional phenomenon. The first three items assess, in succession, the patient's general awareness of a mental disorder, the effects of medication on the disorder, and a general understanding of the consequences of the illness. Subscales 4 to 20 pertain to specific symptoms. Awareness is assessed in the aspect of recognition of signs or symptoms of illness and attribution of the cause or source of these symptoms. In the analyses we used rates of current awareness and attribution, some items were not assessed, i.e. when the subject didn't exhibit the particular symptom. All item scores range from 1 to 5, higher scores indicate poorer awareness or attribution. We computed two overall insight scores: symptoms awareness and symptoms attribution, which were the means of scores patients received in the symptoms subscales.

In order to be rated on PANSS and SUMD subjects were interviewed by experienced psychiatrist of the treatment unit (A.Ch. or W.D.). Information from patient's psychologist or therapist and current medical documentation were also taken into consideration.

Cognitive measures

All subjects were administered a battery of four cognitive tests. Two of the tasks involved visual processing and two other were tests in the verbal domain. Patients were tested individually by a psychologist (M.N. or M.C.).

The testing session started with the measurement of verbal learning and memory. Subjects were presented orally with a list of 15 common words and then were immediately requested to recall as many of the words as they could remember. The procedure consisted of three such consecutive trials and one trial after a 10-minute delay. Two parameters of verbal memory were determined: the sum of all words recalled in the immediate trials, and the total number of words remembered in the delayed trial as a measure of long term retrieval. The visual-spatial ability was assessed with the Block Design subtest from the Wechsler Adult Intelligence Scale - Revised (WAIS-R) [56]. In this test subjects are required to reproduce abstract patterns from a model with colored blocks. In the Category Verbal Fluency task subjects were asked to name exemplars of three categories (animals, clothes, and fruit/vegetables) for one minute each. The score was the total number of correctly generated words. Finally, the Digit Symbol

test from the WAIS-R [56] was administered to assess processing speed, however, it also reflects attention, learning ability and visual-motor functioning. During this test subjects are asked to complete the appropriate symbol under a series of numbers over a period of 90 seconds.

Cognitive skills training

Patients from the experimental group received one 40-50 minutes session of cognitive training per week for 12 weeks. They were divided into 2-3 person subgroups, they were joined according to the similar level of cognitive abilities. During a typical training session, subjects were practicing 5-8 cognitive tasks, each demanding various combinations of cognitive abilities. For example, during one of the sessions patients were engaged in practicing: 1) sorting of cards with geometrical figures, according to their colour and/or number and/or shape; 2) giving words connecting with the word "book" and categorising gathered associations into various classes; 3) searching for words containing letter "b" in a given text; 4) copying complex figures and than drawing them again from memory; 5) making analogies between pairs of objects; 6) assembling a story from fragmented sentences. Specifically for this project, a training manual was developed [57], containing over 70 cognitive tasks, designed to exercise a wide range of cognitive abilities impaired in schizophrenia, among them various aspects of attention, verbal and nonverbal learning and memory, long-term and short-term memory, executive functioning, conceptual thinking etc. The tasks were adopted from other cognitive trainings [e.g., 58] and selected from various cognitive tests described in the literature on methods of testing intellectual abilities [59, 60]. Activities were graduated in complexity, with easier versions of tasks given for subgroups of less-skilled patients. The tests used in this study as pre-treatment and post-treatment measures were not trained during the sessions.

Psychoeducational treatment

Patients from the control group participated in a psychoeducational treatment programme. In the literature this kind of intervention is recommended as reducing risk of relapse, enhancing knowledge about an illness and compliance [e.g., 61, 62, 63, 64]. Materials from a programme of relapse prevention „PRelapse" [65] and earlier experiences with educating patients about their illness were used during the sessions. Patients were divided in two groups (9 or 10 persons in each) and participated in the sessions once a week for 12 weeks.

Psychoeducational courses and cognitive training courses were conducted alternately, therefore some patients were participating in both kinds of interventions (some of them in experimental-control group sequence, some in the opposite control-experimental group sequence). Therefore 10 patients were included in both groups, in these cases the post-test from one intervention was a pre-test of the second kind of intervention.

Results[1]

In all tests of cognitive functioning used there were significant improvements in performance in the experimental group. No significant improvement in these tests was found in the control group. When between-groups comparisons were conducted on the extent of obtained change, it was indicated that patients in the experimental group changed their performance on Verbal Fluency and Block-Design tasks significantly more than patients from the control group did (see Table 2).

Table 2

Cognitive tests performance (mean and standard deviation)

	Experimental group			Control group		
	Pre-test	Post-test	Difference	Pre-test	Post-test	Difference
Immediate recall	14.07" (5.01)	16.73" (5.20)	2.71 (5.15)	13.21 (4.38)	14.68 (4.30)	1.47 (4.50)
Delayed recall	2.71" (2.05)	3.33" (1.93)	0.57 (1.16)	3.16 (2.03)	4.05 (2.41)	0.89 (2.10)
Verbal Fluency	47.57^ (12.38)	52.57^ (14.90)	5.0# (7.70)	47.53 (9.01)	45.79 (11.50)	-1.74# (8.01)
Block Design	19.0^^ (8.7)	23.57^^ (7.54)	4.57## (3.94)	22.24 (6.92)	21.37 (7.45)	-1.47## (3.50)
Digit-Symbol	33.29" (11.94)	36.03" (11.23)	2.23 (3.94)	37.17 (11.30)	37.39 (12.40)	0.22 (0.97)

t test for dependent data, one-tailed: * t=1.97, df=13, p<0.04, ** t=1.85, df=13, p<0.05, ^ t=2.41, df=13, p<0.02, ^^ t=3.44, df=13, p<0.003, " t=2.04, df=12, p<0.04;
t test for independent data, one-tailed: # t=2.31, df=31, p<0.02, ## t=4.07, df=31, p<0.0002

For the symptom measurement, patients from the control group exhibited significant improvement in their overall level of symptomatology, however the extent of this change was not significantly greater than in the experimental group. On the PANSS components the only significant difference between pre-test and post-test was found in the depressive component in the experimental group. Patients from this group were less depressed after participation in the training course, the extent of this change was greater than in the control group (see Table 3).

The improvements in illness awareness were found in both groups. However, they were most apparent in the control group, where significant changes were found on all used SUMD measures. In the experimental group patients improved on the first SUMD general item, that is the item measuring their general awareness of mental disorder, and on the overall score of symptom awareness (see Table 4).

[1] The results presented in this article were published earlier, in Polish, in *Psychiatria Polska* 2002, 36, 745-757

Table 3

Assessment of symptoms severity (mean and standard deviation)

Symptoms	Experimental group			Control group		
	Pre-test	Post-test	Difference	Pre-test	Post-test	Difference
PANSS Total	70.36 (14.26)	67.07 (15.45)	-3.28 (12.10)	75.16* (14.44)	71.89* (16.52)	-3.26 (7.87)
Negative component	23.21 (4.96)	22.36 (4.38)	-0.86 (5.11)	25.53 (6.64)	24.68 (6.60)	-0.84 (3.77)
Delusional-hallucinatory component	10.14 (2.93)	9.71 (3.60)	-0.43 (2.21)	10.53 (3.15)	9.68 (3.27)	-0.84 (2.14)
Hostile-excited component	17.71 (4.21)	17.0 (4.37)	-0.71 (3.10)	19.63 (3.65)	18.74 (4.47)	-0.89 (3.19)
Depressive component	5.43** (1.87)	4.64** (1.82)	-0.78## (1.42)	5.21 (1.90)	5.31 (1.97)	0.10# (1.52)
Thought-disordered component	11.78 (3.94)	11.36 (3.91)	-0.43 (2.17)	12.10 (3.40)	11.47 (3.52)	-0.63 (1.89)

t test for dependent data, one-tailed: * t=1.81, df=18, p<0.05,** t=2.06, df=13, p<0.03;
t test for independent data, one-tailed: # t=1.71, df=31, p<0.05

Table 4

Assessment of insight (mean and standard deviation)

SUMD	Experimental group		Control group	
	Pre-test	Post-test	Pre-test	Post-test
SUMD General items				
Mental disorder	2.50^ (1.40)	2.14^ (1.40)	2.42^^ (1.02)	2.21^ (1.05)
Effects of medication	1.78 (1.42)	2.0 (1.57)	2.10^^ (1.20)	1.52^^ (1.30)
Social consequences	2.21 (1.43)	2.07 (1.54)	1.74# (1.10)	1.63 # (1.11)
SUMD Overall scores				
Symptom awareness	2.71** (1.23)	2.35** (1.44)	2.70 ## (0.90)	2.52 ## (0.96)
Symptom attribution	2.27 (1.42)	2.43 (1.54)	2.00^ (1.13)	2.71^ (1.21)

Wilcoxon test for dependent data, one-tailed: * z=1.62, p=0.05; ** z=1.75, p<0.05;
^ z=2.01, p<0.03; ^^ z=1.87, p<0.04; # z=2.0, p<0.03; ## z=2.84, p<0.003;" z=2.04, p<0.03

Discussion

The study indicated that the described method of cognitive skills training may be effective in rehabilitation of cognitive functions in people with schizophrenia. Verbal skills (words recall, verbal fluency) as well as visual processing (abilities of perception organisation and visual-motor coordination), and psychomotor speed improved in patients participating in training sessions. It was shown that psychoeducational intervention had no such effect on cognitive funtioning. Patients from the control group changed their performance between pre- and post-test only slightly, this change was probably due to the test familiarity. The comparison of the extent of change between groups proved that the experimental group improved their verbal fluency and visual-processing ability to a significant greater degree than the control group.

In a pilot study [52] conducted two years earlier, patients participated in sessions of cognitive training twice per week. They significantly improved in verbal fluency and language comprehension tasks, while recognition memory and conceptual thinking did not improve significantly. The study presented here indicated that less intensive intervention is also effective and that some other cognitive functions are responsive to rehabilitation.

Contrary to our expectations, the training effects did not transfer to the pre-post training improvements on symptomatology. Although the severity of most symptoms lowered after the training, these changes were mostly not significant. This failure was especially unexpected in regard to negative symptoms. The literature is consistent that the degree of cognitive impairment is associated with the severity of these symptoms [e.g., 42, 66, 67, 68]. In particular a considerable number of studies have concluded that verbal fluency, an ability successfully enhanced in our study, is related to negative symptoms [eg., 31, 69, 70, 71]. The lack of change in negative symptoms severity in spite of cognitive improvements may be due to the specificity of the examined group – most participants were in their 40's, they had long illness duration and persistent functioning schemata. It is also possible that, in fact, there is no casual relationship between the course of negative symptoms and cognitive deficit in schizophrenia [cf. 30]. Another explanation is that the improvement in cognitive functioning was too small to generalise to improvements in symptomatology. All these hypotheses need further research.

In our study, patients from the experimental group significantly improved on the PANSS depressive component. However, this benefit may not be due to specific cognitive training effects (i.e., improvements in cognition or insight) but may be due instead to the presence of non-specific elements, such as friendly atmosphere during the sessions, optimism connected with a new form of rehabilitation etc. This cautious interpretation was imposed by some findings reported in the literature. For example, Lysaker et al. [72] have indicated that greater levels of cognitive deficit are associated with higher levels of hope. Moreover, other studies demonstrated that higher levels of depression are associated with good awareness [e.g., 39, 49, 73, cf.,74].

Both psychoeducational intervention and cognitive training improved patients' awareness of the illness. However, it must be noted that the influence was more preva-

lent in the psychoeducational group than in the experimental group. It is consistent with some other studies which have reported improvements in patients' insight scores after participation in educational programs [39, 75, 76]. It is possible that patients improved their insight scores not due to a deep change in their attitudes and beliefs about illness but rather because they became more skilled in verbalising and explaining their illness. However, we believe that this change in patients' knowledge about mental illness is also a valuable treatment effect which may contribute to improvements in patients' compliance or quality of life.

The main limitation of our study was small sample size. Also too few patients participated in both treatment interventions to address the hypothesis that enhancement of cognitive skills would improve the effectiveness of psychoeducation. Another limitation was that both psychologists and psychiatrists who were assessing patients' symptomatology and cognitive functioning were not blind to the type of treatment the patient had received. Moreover, the durability of treatment effects and their generalisability to social skills or quality of life should be studied in further research.

Conclusions

1. Patients participating in a training of various cognitive skills significantly improved their performance on verbal memory, verbal fluency, visual processing and psychomotor speed tests.
2. These training effects did not transfer to significant enhancement of symptomatology.
3. Patients from the experimental group improved some aspects of illness awareness, however the improvement was more prevalent in the control group of patients participating in psychoeducational intervention.

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