Archives of Psychiatry and Psychotherapy, 2009 ; 3 : 27–34

The relationship between cognitive deficits and the course of schizophrenia. Preliminary research on participants of a rehabilitation programme

Igor Hanuszkiewicz, Andrzej Cechnicki, Aneta Kalisz

Summary

Aim. The purpose of this paper is to evaluate the relationship between the course of illness, the results of rehabilitation and the type and severity of cognitive disorders in a group of patients diagnosed with chronic schizophrenia.

Methods. The assessment of cognitive deficits includes efficiency of executive functions and working memory tested with the WCST and the Trail Making Test as well as the assessment of the verbal and category fluency. Four indicators of the course of schizophrenia were considered: the severity of psychopathological symptoms evaluated with the PANNS, social contacts and professional functioning evaluated using a clinical scale, and quality of life evaluated with the Lancashire Quality of life Profile. The subjects were 64 patients with diagnosis of schizophrenia, as defined in DSM-IV and ICD-10, who participated in the rehabilitation programme.

Results. It has been shown that lower results in the verbal fluency test are related to an increased severity of negative symptoms, lesser readiness to take up a job, a lower number of social contacts and a lower evaluation of the indicators of quality of life in the domains of work, privacy level and satisfaction derived from the time spent outside of one's home. The results of the TMT correlate with the severity of negative symptoms and general symptoms evaluated with the PANSS as well as with the readiness to take up employment. The number of correct answers in the WCST correlates with the age of the first hospitalisation and readiness to take up a job. Persons with higher education made fewer perseverance errors. A lower number of non-perseverance errors corresponds with being employed before or after the onset of the illness. Persons who completed the first section of the test faster are the ones with a higher number of social contacts.

Conclusions. The study found relationships between the severity of cognitive deficits and the majority of tested indicators of rehabilitation outcomes in the group of persons with a long history of schizophrenia.

schizophrenia / course of illness / cognitive deficits

INTRODUCTION

In the last years, the dominant view has claimed that cognitive deficits are the "primary" disorder and usually precede the clinical manifestation of first symptoms of schizophrenia by many years [1]. However, for a long time disorders of cognitive functions in schizophrenia were considered secondary to psychosis. In clinical descriptions by Kraepelin [2] and Bleuler [3] deficiencies in perception and intellect held a significant place. In 1945 Rappaport stated that deficits in correct judgement, attention, concentration, planning and the ability to anticipate are characteristic of schizophrenia [4]. In the context of heterogeneity of disorders in schizophrenia, the term "cognitive deficit" calls for distin-

Igor Hanuszkiewicz, Andrzej Cechnicki, Aneta Kalisz: Laboratory of Community Psychiatry, Dept. of Psychiatry, CM UJ, Kraków, Poland. Correspondence address: Andrzej Cechnicki, Community Psychiatry Section, Chair of Psychiatry, Collegium Medicum, Jagiellonian University, 2 Sikorskiego Pl. Apt. 8, 31-115 Kraków, Poland

This research has not been aided by any grant.

guishing from the complex symptomatology of this illness.

For many years the prevailing goal of research on schizophrenia was to create a precise description of the illness and to isolate specific groups of symptoms [5]. The researchers differentiated productive (positive) symptoms, such as thought disorder, hallucinations and delusions from negative symptoms, i.e. passivity, inclination to seclude oneself or impoverished speech [6]. Unlike these well described syndromes, positive and negative, cognitive deficits are defined rather in an operational way, by using appropriate tests. Among the cognitive deficits, those most often encountered in experimental research are: attention disorders [7], deterioration of memory [8], small flexibility of thinking as a result of the impairment of the task prioritizing ability, which Goldberg [9] describes as inability to use available information. Many researchers are of the opinion that in persons with schizophrenia the IQ diminishes, however, in the middle of the last century Wechsler [10] already noted that the decrease pertains mainly to the non-verbal scale. The research with application of precise neuropsychological tests shows that these deficits also affect the verbal sphere and manifest themselves, among others, by a lesser ability to "produce" words than it is the case in the population of healthy persons [11].

The particular elements of information processing are so closely connected that it is hard to imagine attention disorders not influencing negatively the remembering process or the use of available information. In research this translates into use of many tests (often computer-based) enabling the assessment of separate functions as well as general functioning. In such studies it has been demonstrated that the level of cognitive functioning may, to a much greater degree than positive or negative symptoms, explain social and professional adjustment and the course of illness [12]. Many researchers emphasize that cognitive deficits are a very stable symptom in persons ill with schizophrenia, and to large extent it is independent of the course of the illness or the duration of symptoms [13].

AIM OF THE STUDY

The purpose of the study is the assessment of cognitive deficits and their effect on the outcome of a 3-year rehabilitation programme for persons suffering from chronic schizophrenia. The research goals were formulated as follows: 1. the assessment of the rehabilitation outcome and its relation to cognitive deficits in the area of psychopathology after three years of participation in the programme, 2. the assessment of the rehabilitation outcome and its relation to cognitive deficits in the scope of social and professional functioning after three years of participation in the programme, 3. the assessment of the rehabilitation outcome and its relation to cognitive deficits in the aspect of subjective evaluation of the quality of life after three years of participation in the programme.

SUBJECTS

The subjects were 64 persons with schizophrenia diagnosed in accordance with DSM IV and ICD-10 criteria. The persons included in the study were qualified for a long-term rehabilitation programme due to a particularly disadvantageous course of illness.

The testing was conducted in the third year of the programme operation.

Table 1. Initial stages of the professional rehabilitation programme in Kraków.

The Outpatient Clinic for Therapy and Rehabilitation of Psychoses. Qualification process.
↓
Day Care Rehabilitation Unit
↓
Occupational Therapy Workshop
OBSERVATION OF THE OUTCOMES OF REHABILITATION
EVALUATION AFTER THREE YEARS OF THE PROGRAM

Altogether 27 (42%) women and 37 (58%) men participated in the study. The average age of the participants was 35 years; the youngest participant was 21, the eldest 55 years. All subjects had lost their jobs. 10 persons (16%) had higher education, 6 persons (9%) had incomplete higher education, 26 persons (41%) had secondary ed-

ucation, 22 persons (34%) had elementary education. 7 persons were married, 4 persons divorced, 53 were single. The prevailing majority of the subjects had very scarce social contacts, comprising mainly their own generational families or the patients' community. The average age of the first hospitalisation was 23 years, the average time span of the illness was 12 years (from 3 to 29 years). The average number of hospitalisations per person was 3.7. Half of the subjects had been hospitalised more than twice, 15 percent of the subjects had been hospitalised over 6 times.

METHODS

In order to assess the psychopathological condition of the subjects the PANSS was employed and separate analyses of general symptoms as well as positive and negative syndromes were performed. Cognitive deficits were assessed with the Verbal and Category Fluency Test, the Trail Making Test to evaluate psychomotor speed and visual-spatial operational memory, and with the WCST, which is particularly sensitive in the evaluation of frontal lobe dysfunctions such as planning ability and the efficiency of executive functions [1]. Verbal fluency was assessed using letter and category tests. In the letter test, the subject's task was to utter as many words starting with a given letter of the alphabet as possible, within 1 minute. In the category test, the subject's task was to say as many words fitting a given category as possible, within 1 minute. The Trail Making Test consists of points drawn on an A4 sheet, the subject's task being to connect them by drawing a line. In the A version, subsequent numbers should be connected in sequence; 1 with 2, then with 3 and so on. In the B version, the correct way of connecting the points is to alternately connect numbers and letters of alphabet; 1 with A, then with 2, then with B, and so on. The B version is therefore harder to complete, because of the necessity of switching attention between two automated sequences: counting and alphabet. The result is the time needed to complete each task. The Wisconsin Card Sorting Test (WCST) consists of cards the subject is asked to sort by matching the patterns in accordance with a directly undisclosed principle, which changes during testing. The subject knows if he/she is using the right principle by the feedback from the experimenter. The results are scored as follows: the number of attempts needed to complete the whole test, the number of errors of perseverative and non-perseverative nature, the number of correct answers and the number of attempts before completing the first category.

The evaluation of "the readiness to take up a job" was performed on a 5-point Likert-type scale. It had been taken into account that the subjects are a very homogenous group. Most of them have not had a job for years and they remain professionally inactive. The highest ranked response on the scale was taking up a job on the free labour market. The remaining points contained descriptions of "the readiness to take up a job" analysed across three essential dimensions: a) professional skills and perseverance in activities, b) self-reliance and self-direction, c) cooperation and communication with colleagues and supervisors. It was assumed, that "the readiness to take up a job" is an important success in the rehabilitation process in view of the high rate of unemployment, which constitutes an additional obstacle in carrying out this intention. To assess social contacts a clinical Likert-type scale was used, where the lowest ranked contacts were limited to the subject's family, then the contacts limited to a group of patients, and the highest ranked contacts outside the subject's family and a group of patients.

Quality of life was evaluated with the Lancashire Quality of Life Profile constructed by Joseph Olivier of the University of Manchester. The questionnaire is in a form of a structured interview, containing patient's "objective" account of his/her current level of psycho-social functioning in several domains of life, and his/her "subjective" evaluation of his/her satisfaction derived from functioning in these domains. The questionnaire comprises of general sections: client's personal information, general well-being, work/education, leisure, religion, finances, living situation, legal/safety, family relations, social relations, health, and self-image. This study includes only subjective evaluations pertaining to each of the above mentioned domains. The evaluations were made on a 7-point Likert-type scale of satisfaction, where "1" denoted "could not be worse" and "7" denoted "could not be bet-

ter". The subjects were divided, in accordance with their results, into three groups: the dissatisfied (responses on the scale ranging from 1 to 3), the ambivalent (responses on the scale equal 4), and the satisfied (responses on the scale ranging from 5 to 7). The same division was adopted by Cechnicki and Valdes [14].

RESULTS

The relation between the outcomes of rehabilitation and the severity of cognitive deficits was assessed. Comparing the results obtained in tests of cognitive functions after three years of the rehabilitation programme's implementation with the results of similar studies, it can be stated that the obtained results are lower than in the population of healthy individuals [15, 16, 17] and are characteristic of persons with schizophrenia diagnosis [18, 19, 20].

The subjects on average did not score more than 13 words in the Verbal Fluency Test and not more than 17 words in the Category Fluency Test within the time of 1 minute. Completion of the Trail Making Test exceeded on average 1 minute in the A version and lasted on average almost 3 minutes in the B version. The WCST showed mainly non-perseverative errors. The number of attempts needed to complete the first category turned out to be high (Tab. 2).

Table 2. Cognitive functions of the subjects

Tests assessing cognitive deficits	Mean	Standard deviation
Verbal Fluency Test – number of words starting with "A"	11.4	5.7
Verbal Fluency Test – number of words starting with "S"	12.8	5.7
Category Fluency Test – number of words	17.1	6.6
Trail Making Test - A version (in seconds)	71	33
Trail Making Test - B version (in seconds)	151.2	78.6
WCST – number of correct matches	66.6	17.7
WCST – number of errors	40.4	27.8
WCST – number of attempts prior to completing the first category	24.9	29.5
WCST – number of non-perseverative errors	41.1	28.00
WCST – number of perseverative errors	18.5	14.9
WCST – number of correctly matched categories	4.1	2.2

The relation between cognitive deficits and the severity of psychopathology.

The results obtained with the PANSS demonstrate a fixed, low level of positive symptoms (the average score of 16.5 out of a maximum of 49), moderate level of negative symptoms (the average score of 41.8 out of a maximum of 112). The subjects make up a group in which negative symptoms predominate over positive ones proving a disadvantageous course and increase of disorders (Jablensky – types of courses WHO). The study demonstrated the existence of a relationship between the severity of psychopathological symptoms and cognitive deficits (Tab.3).

Table 3. Correlations between the results of tests assessing cognitive deficits and psychopathological variables

Tests	PANSS – negative symptoms	PANSS – general psychopathology
Verbal Fluency Test – number of words starting with "A"	-0.27*	
Trail Making Test – A version	0.36**	0.29*

Correlations estimated using Spearman's rank correlation coefficient, *p≤0.05; **p≤0.01

The results of the fluency test for the assessment of verbal functioning turned out to be related to negative psychopathology. The Trail Making Test (in a simplified version) was performed with poorer results by persons with more negative symptoms and a higher level of general psychopathology. The persons who had become ill later in life give more correct responses in the WCST. There was no relation found between cognitive deficits and positive symptoms in the studied group.

The relationship between cognitive deficits and professional functioning.

None of the 64 subjects took up a job on the open labour market after three years of the rehabilitation programme. 12% of the subjects were employed in sheltered work settings or performed odd jobs. The remain-

ing 88% did not take up any job, of that 17% did not meet one condition and 59% - two or three conditions determining readiness to take up a job. 12% of the subjects refused participation in the professional rehabilitation programme.

Two parameters of the WCST turned out to be statistically significant correlates of actual employment of the ill persons. A higher number of correct responses in the WCST, better verbal fluency and a shorter time of completion of the Trail Making Test - the more difficult B version -showed a statistically significant relationship with higher professional competencies of the ill persons after the completion of the rehabilitation programme (Tab. 4).

The relationship between cognitive deficits and social functioning

After three years of participation in the rehabilitation programme, social contacts of 31 subjects (48%) were restricted to the closest family, 21 persons (32%) maintained contacts limited to the patients' community, 13 persons (20%) had also contacts outside the patients' community (Tab. 5).

The greater extent of social contacts assessed after three years of operation of the rehabilitation programme was related to lower level of cognitive deficits as evaluated with the Verbal Fluency Test and the A version of the Trail Mak-

Table 4. Correlations between the results pertaining to professional competency and occurrence/ severity of cognitive deficits.

Professional competencies – appraisal after 3 years of rehabilitation	WCST – number of correct answers	Verbal Fluency Test – number of words (s)	Verbal Fluency Test – number of words (a)	TMT (B) – time in seconds
A higher appraisal of professional competencies	0.30*	0.34*	0.42**	-0.34*

Correlations estimated using Spearman's rank correlation coefficient, *p≤0.05; **p≤0.01

Table 5. Correlations between the quantity and quality of social contacts and occurrence/ severity of cognitive deficits.

Results after 3 years of rehabilitation	Verbal fluency – number of words (a)	Verbal fluency – number of words (s)	Trail Making Test (a) – time in seconds	Number of attempts prior to completing the first category f (WCST)
Broader scope of social contacts	0.33*	0.35*	-0.35*	-0.36**

Correlations estimated using Spearman's rank correlation coefficient, *p≤0.05; **p≤0.01

ing Test. The persons who had more social contacts needed less attempts in order to complete the first category of the WCST.

The relationship between cognitive deficits and the subjective evaluation of the quality of life.

After three years of the rehabilitation programme, more than half of the subjects (52%) declared satisfaction in the domain of work, understood as the activities at Occupational Therapy Workshops (12% were dissatisfied and 36% had ambivalent feelings). As far as the activities outside home except workshops are concerned, 52% of the subjects were satisfied (19% were dissatisfied, 29% had ambivalent opinions). Regarding the level of privacy in their own home, 53% were satisfied (17% were dissatisfied and 36% had ambivalent feelings). Tab. 6 (next page)

The level of satisfaction with activities the subjects take part in, outside of home is in a statistically significant relation to the results of the category fluency test. The satisfaction of the level of privacy and the satisfaction with professional activities (at work and at occupational therapy workshops) is in a statistically significant relation to the results of the verbal fluency test. The evaluation of the quality of life was not related to cognitive deficits assessed with the Trail Making Test and WCST.

Table 6. Statistically significant differences in the results of the Fluency tests in the groups of satisfied and dissatisfied persons across various domains.

Fluency test/ quality of life assessment domain	Satisfied		Dissatisfied		significance level
	mean	standard deviation	mean	standard deviation	
Categorial fluency/ Leisure	17.36	4.87	13.50	5.17	p=0.03
Verbal fluency/ Living situation – privacy level	12.05	5.99	9.88	5.17	p=0.03
Verbal fluency/work	11.60	5.19	7.62	4.53	p=0.05

Differences estimated using t-test

DISCUSSION

The results obtained in the assessment of cognitive dysfunctions are similar to results presented in other research papers, in which it was demonstrated that persons with a schizophrenia diagnosis perform the tests employed in this study at a lower level than a population of healthy individuals. The average number of errors in the WCST made by subjects of Voruganti et al. [18] equalled 46, while in the same study, healthy persons made on average 7 errors. Everett et al. [21] demonstrated that persons with a schizophrenia diagnosis, in comparison to a group of healthy individuals, completed fewer categories, made more errors of perseverative nature (28), needed more attempts to complete the first category (over 30). Similar results were obtained by Morice [22]. Also the results of the Trail Making Test and the Verbal Fluency Test obtained in this study are similar to results of other researchers [1, 12].

In the presented study cognitive deficits are related to the severity of psychopathology through correlations with the negative syndrome, which coincides with results of other researchers [20, 23]. However, taking into account the relatively low correlation with verbal fluency and lack of correlation with the WCST results in this study, we have to assume that the obtained results indicate only a partial relationship between the negative syndrome and cognitive deficits, as well as a difficulty to unequivocally determine the interrelations between these phenomena.

The interdependencies between social and professional functioning and cognitive deficits in schizophrenia are among the well substantiated in numerous research studies [12, 24]. In the presented study, correlations of socio-professional variables with clinical variables are prevailing. The presumed cause of this may be the considerable power of socio-professional variables as well as the results of the tests assessing cognitive deficits to verify "the general adaptation level". Focusing on a group of patients suffering from symptoms of schizophrenia, it needs to be noted, that in day-to-day diagnosis the key factor is not the results of cognitive tests but the presence of clinical symptoms, which can be related to specific deficits only indirectly. A multidimensional clinical picture as opposed to a hierarchically organised picture of cognitive disorders [25] still remains a better tool to define the limits of schizophrenia. As noted by Mosiołek i Łoza [23], despite numerous empirical reports on distinct relationship between schizophrenia diagnosis and the presence of perseverative errors in the WCST results, nobody dared to put forward a hypothesis on a greater significance of these results than of delusions.

The assessment of the quality of life differs from the other evaluated dimensions due to its subjective nature. The interpretation of the obtained results may be difficult, because the assessment of the quality of life can be viewed as an intermediary variable. A lower evaluation of satisfaction from work or the time spent outside of home by a group of individuals demonstrating a lower verbal fluency can arise from the fact that they are less skillful in contacts with others and thereby they feel less comfortably in situations requiring such contact. Another possible interpretation indicates that exactly the higher level of cognitive deficits affects the general tendency to a lower self-esteem and thus a lesser satisfaction. It may be the case, that these methodological complexities are the reason for which there is so few studies of the relationship between cognitive deficits and the quality of life of individuals suffering from schizophrenia, and

the results indicate little to no correlation [26]. Therefore it is all the more important that in the presented study, out of a number of results, the ones that turned out to be significant for self-esteem pertained to the verbal function, proper functioning of which is necessary for a complete communication. This outcome implies that communication competence plays a big part in the evaluation of the quality of life and, indirectly, in the self-esteem of individuals ill with schizophrenia.

CONCLUSIONS

Relationships between the severity of cognitive deficits and the majority of the evaluated outcomes of rehabilitation programme have been found in a group of individuals with a long-term course of schizophrenia.

1. It has been demonstrated that high level of verbal fluency corresponds with the majority of good outcomes of the rehabilitation.
2. There was no relationship found between the severity of cognitive deficits and the severity of positive symptoms in the third year of the rehabilitation programme.
3. Studies of the relationship between cognitive functioning and the outcome of a rehabilitation programme constitute a valuable hint for constructing treatment programmes for persons suffering from schizophrenia.

REFERENCES

1. Borkowska A. Rybakowski J. Deficyty poznawcze w schizofrenii In: Borkowska A. (ed). Zaburzenia funkcji poznawczych w chorobach psychicznych. Kraków: Biblioteka Psychiatrii Polskiej; 2005. p. 7–29.
2. Kraepelin E. Psychiatrie. Ein Lehrbuch fur Studierende und Ärzte. Leipzig 8 Auflege: Barth; 1913.
3. Bleuler E. Dementia Praecox or the Group of Schizophrenias (J. Zinkin, Trans.). New York: International Universities Press; 1945.
4. Rappaport D, Gill M, Schafer R. Diagnostic Psychological Testing. Chicago: Year Book; 1945.
5. Kay SR, Fiszbein A, Opler A. The Positive and Negative Syndrome Scale (PANSS) for schizophrenia. Schizophr. Bull. 1987; 13: 262–276.
6. Andreasen NC, Olsen S. Negative v positive schizophrenia. Definition and validation. Arch Gen Psychiatry 1982; 39(7): 789–94.
7. Hirt M, Pithers W. Selective attention and levels of coding in schizophrenia. British Journal of Clinical Psychology 1991; 30: 139–149.
8. Carter CS, Barch DM. Attention, memory and language disturbances in schizophrenia: characteristics and implications. Advances in Psychiatry 2000; 3: 45–72.
9. Goldberg TE, Weinberger DR, Berman KF, Pliskin NH, Podd MH. Further evidence for dementia of the prefrontal type in schizophrenia? A controlled study of teaching the Wisconsin Card Sorting Test. Arch Gen Psychiatry 1987; 44(11): 1008–14.
10. Wechsler D. The measurement of the adult intelligence. Williams and Wilkins, Baltimore; 1941; 145–162.
11. Henry J, Crawford J. A meta-analytic review of verbal fluency deficits in schizophrenia relative to other neurocognitive deficits. Cognitive Neuropsychiatry 2005; Vol. 10 (1): 1–33
12. Weinberger DR, Gallhofer B. Cognitive function in schizophrenia. Int Clin Psychopharmacol. 1997; 12(Suppl 4): 29–36.
13. Goldberg TE, Hyde TM, Kleinman JE, Weinberger DR. Course of schizophrenia: neuropsychological evidence for a static encephalopathy. Schizoph Bull 1993; 19(4): 797–804.
14. Cechnicki A, Valdes M. Relation between schizophrenic patients‘ quality of life and symptom severity. Archives of Psychiatry and Psychotherapy 2003; 3: 55–69.
15. Harvey PD, Keefe RS. Cognitive impairment in schizophrenia and implications of atypical neuroleptic treatment. CNS Spectr 1997; 2: 1–11.
16. Heinrichs RW, Zakzanis KK. Neurocognitive deficit in schizophrenia: a quantitative review of the evidence. Neuropsychology 1998; 12(3): 426–445.
17. Saykin AJ, Gur RC, Gur RE. Neuropsychological function in schizophrenia. Selective impairment in memory and learning. Arch Gen Psychiatry 1991; 48(7): 618–624.
18. Voruganti L, Heslegrave R, Award A. Neurocognitive correlates of positive and negative syndromes in schizophrenia. Can J Psychiatry 1997; 42: 1066–71.
19. Arduini L, Kalyvoka A, Stratta P, Rinaldi O, Daneluzzo E, Rossi A, Insight and Neuropsychological Function in Patients With Schizophrenia and Bipolar Disorder With Psychotic Features. The Canadian Journal of Psychiatry 2003; Vol 48, 5: 338–341.
20. Borkowska A, Robakowski J. Wpływ preparatu oalanzapiny na funkcje poznawcze w schizofrenii. Farmakoterapia w Psychiatrii i Neurologii 2005; 4: 389–395.
21. Everett J, Lavoie K, Gagnon J-F, Gosselin N. Performance of patients with schizophrenia on the Wisconsin Card Sorting

Test (WCST), Journal of Psychiatry & Neuroscience 2001; 26, 2: 123–130.

22. Morice, R. Cognitive inflexibility and prefrontal dysfunction in schizophrenia and mania. British Journal of Psychiatry 1990; 157: 50-54.
23. Mosiołek A, Łoza B. Co mierzą testy neurokognitywne w schizofrenii? Psychiatria 2004; 1, 2: 113–119.
24. Velligan DI, Bow-Thomas CC, Mahurin RK, Miller AL, Halgunseth LC. Do specific neurocognitive deficits predict specific domains of community function in schizophrenia? J. Nerv. Ment. Dis. 2000;188(8): 518–24.
25. Andreasen NC. Unitary model of schizophrenia. Arch. Gen. Psychiatry 1999; 56: 781–787.
26. Heslegrave RJ, Awad AG, Voruganti LNP. The influence of neurocognitive deficits and symptoms on quality of life in schizophrenia. J. Psychiatry Neuroscience 1997; 22; 4: 235–243.