RESEARCH ARTICLE

ACTA Vol. 12, No. 3, 2014, 271-291
NEUROPSYCHOLOGICA

Received: 12.12.2013
Accepted: 02.06.2014

A – Study Design
B – Data Collection
C – Statistical Analysis
D – Data Interpretation
E – Manuscript Preparation
F – Literature Search
G – Funds Collection

DOI:10.5604/17307503.1124954

EXECUTIVE FUNCTIONS OF SCHIZOPHRENICS ADDICTED TO NICOTINE

Ilona Bidzan[A,B,C,D,E,F,G]

St. Vincent a Paulo Hospital in Gdynia, Poland

SUMMARY

Background: The aim of this study was to assess the relation between nicotine addiction and the level of executive functions of individuals suffering from schizophrenia.

Material/ Methods: The clinical Group I consisted of schizophrenics addicted to nicotine (N=31), while the clinical Group II comprised non-smoking schizophrenics (N=28). The control groups included healthy individuals who smoke cigarettes (N=29) and healthy non-smokers (N=30). To conduct the study, a Self-developed Questionnaire, the Trail Making Test and the Wisconsin Card Sorting Test were used. The nicotine addiction degree was measured by the Fagerström Test.

Results: The level of executive functions of cigarette smoking schizophrenics is higher when compared to non-smoking patients and is related to better results achieved in the Wisconsin Card Sorting Test in terms of: the number of trials, number of errors, percentage of correct answers, number of passed categories. The degree of nicotine addiction in the study group proved not to be related to the level of executive functions, nevertheless, the nicotine addiction duration had a positive impact on the number of passed categories in the Wisconsin Card Sorting Test in the group of schizophrenics. No relation was observed between the number of hospitalizations and gender, and the level of executive functions of the patients.

Conclusions: The level of executive functions of cigarette-smoking schizophrenics is higher when compared to non-smoking patients.

Key words: cognitive functions, memory, behaviour, problem solving

INTRODUCTION

Previous studies have revealed that not only do schizophrenics smoke cigarettes twice more often than individuals with other mental disorders, but also that they smoke many more of them, and the addiction strength in this group is higher (Williams, Foulds, 2007). It is estimated that 70-90% of schizophrenics smoke cigarettes, compared with 23-30% of smokers in the control group (Devaux, 2008; Pietras, Witusik, 2011). Obviously, schizophrenics are not the only group of patients smoking excessive numbers of cigarettes. Clinical observations and scientific research have demonstrated that this also applies to individuals with depression (Breslau et al., 1993, Kendler et al., 1993). Studies conducted in psychiatric hospitals revealed that schizophrenic patients smoke more than one pack of cigarettes daily, chain-smoke and smoke each cigarette completely, right up until they reach the filter (Williams, Ziedonis, 2004). We have to bear in mind that the actual end of a cigarette contains harmful elements and the largest amount of nicotine (Devaux, 2008).

Assuming that the maladaptive smoking pattern, leading to clinically significant limitation or suffering and manifesting itself during a 12-month period with three (or more) of the symptoms listed below, the criteria for nicotine addiction would be as follows:

- Nicotine tolerance;
- State of withdrawal, manifesting itself with a characteristic nicotine withdrawal syndrome, or taking the same or very similar substance in order to avoid withdrawal symptoms or a relieving of them;
- Smoking tobacco in large amounts for a period of time longer than intended;
- Constant desire or unsuccessful attempts to cut down on smoking or control it;
- Spending a lot of time trying to acquire tobacco, use tobacco or reverse its effects;
- Terminating, abandoning or limiting socially significant professional or leisure activities due to nicotine abuse;
- Continuing to smoke cigarettes despite the awareness of permanent or recurring physical and psychological problems, probably caused or worsened by tobacco (after: Pietras, Witusik, 2011).

By 2000, the percentage of individuals without any mental disorders who smoke cigarettes had decreased from 45% to a max. of 30%. However, the number of smokers among schizophrenics remains unchanged (Devaux, 2008). One of the hypotheses explaining this state of affairs is the positive impact of nicotine on the cognitive and emotional functioning of schizophrenics.

It is estimated that 85-90% of patients had started smoking before they fell ill. Apart from that, more teenagers who smoke develop schizophrenia than non-smoking ones (Habrat, 2004). Studies confirming these results were conducted in Israel. 14 248 men aged 18 years were observed for 4-16 years. It was revealed that a man smoking 1-9 cigarettes daily had 1.4 times lower chances of being hospitalized, and those smoking more than 10 cigarettes – 2.3 times

(Weiser et al., 2004). This means that smoking tobacco is an early harbinger or a risk factor in developing a psychotic episode (ibidem).

However, in the case of non-smoking schizophrenics who had controlled their smoking in their youth, and developed schizophrenia at an earlier age, the illness lasted longer compared to smoking patients and former smokers with schizophrenia (Habrat, 2004).

Nicotine and the cognitive processes of schizophrenics

Smoking cigarettes by psychiatric hospital patients has long been associated with the boredom prevailing in hospital wards. Nonetheless, the results of a few studies conducted in recent years have brought some inordinately/extremely interesting observations.

Some studies demonstrated that smoking cigarettes by schizophrenics has its positive aspects. They refer inter alia to cognitive processes. For example, the results of a study conducted by Cattapan-Ludewig et al. (2005) indicate that schizophrenics who smoke have better cognitive functions (e.g. scope of attention, alternating attention, working memory, short-term memory, recalling) than non-smoking patients.

Meanwhile, a study conducted by Smith et al. (2006) revealed that nicotine improved both attention and spatial memory of schizophrenics. The results obtained by Jacobsen et al. (2004) indicate the positive impact of nicotine on operational memory and attention selectivity. According to these authors, this is due to enhanced activation and functionality of connections amongst those parts of the brain involved in the performance of tasks.

In turn, according to Ma et al. (2010), former smokers achieved lower results in the Stroop Test, compared to current smokers. It is emphasized that smoking can serve as a self-treatment of cognitive functions deficiencies, especially in the case of a patient taking small doses of neuroleptics, or smoking an average number of cigarettes. It decreases the productive and negative symptoms (Bidzan, 2007a; Stahl, 2008). One of the elements of the self-treatment of cognitive functions deficiencies is nicotine's stimulation of the dopaminergic mesocortical pathway, something which enhances cognitive functions (Stahl, 2008). The underactivity of this pathway is typical of schizophrenia; it can be caused by both neurodevelopmental deficiencies, as well as, most probably, the lack of stimulation by the glutamineric neurons of the corticospinal tract, which in turn stimulates the mesocortical pathway (ibidem).

The kind of neuroleptics taken by the patients also affects the number of cigarettes they smoke. Classical neuroleptics were related to longer period of hospitalization and large numbers of cigarettes smoked (George et al., 2000). The studies conducted in Gdańsk revealed that smokers have a need to take higher doses of neuroleptics. However, this does not have to be connected directly with addiction. It is clear at this stage of research that haloperidol certainly increases the number of cigarettes smoked daily. Withdrawing it and substituting it with clozapine decreased the number of smoked cigarettes (Bidzan, 2007b). George

et al. (2000) also observed a decrease in the daily number of cigarettes smoked under the impact of clozapine.

Smoking tobacco during neuroleptic treatment may be the cause of dyskinesia. Apart from that, smoking and taking larger doses of neuroleptics impairs motor functions, especially in women. Nonetheless, apart from the aforementioned disorders, smoking cigarettes reduces some of the extrapyramidal symptoms caused by neuroleptics (Bidzan, 2007a,b, Bidzan et al. 2014).

The substances contained in tobacco smoke cause for a quick metabolism of antipsychotic drugs (Habrat, 2004), nevertheless, an increased dosage of a neuroleptic in the case of patients who smoke does not have to be related directly to smoking itself (Bidzan, 2007b).

Executive functions of schizophrenics

Executive functions, also called executive control functions, control the processes responsible for forming simple notions, transforming movements into complex activities and directing action to an aim. Executive functions are also related to creative and abstract thinking, insight, the processes of analysing human needs, desires and the ways of their fulfilment (Pawełczyk, Pawełczyk, 2007; Pąchalska, 2007). Executive functions allow us to set a goal we want to achieve, to develop and implement an action plan, making it possible to achieve our goals, correct and modify our behaviour under changing conditions, adhere to our intentions despite distractions (ibidem).

The most important cognitive deficiency in schizophrenia is operational memory and executive functions disorders. This is related to anomalies in the dorsal-lateral prefrontal cortex (Hintze et al., 2007). The study results have revealed that executive functions disorders impede planning, problem solving, decision making, abstracting and the plasticity of cognitive processes (Pawełczyk, Pawełczyk, 2007).

The main aim of the undertaken research was to assess the relation between nicotine addiction and the level of executive functions of schizophrenics.

As a result of this study aim, the following research questions were posed.

1. What is the level of executive functions of schizophrenics when compared to healthy individuals?
2. What is the level of the executive functions of schizophrenics who smoke cigarettes when compared to non-smoking patients?
2. Is the degree of nicotine addiction in the study groups related to executive functions, and if so, in what way?
3. Is there a relation, and if so, of what kind, between socio-demographic factors (the number of hospitalizations, level of education and marital status) and executive functions?

Study group

The research projects included 118 individuals, divided into 4 study groups:

I. a clinical group, including 31 individuals (19 men and 12 women, average age 38.22 years) with diagnosed schizophrenia, addicted to nicotine;

II. a clinical group, including 28 individuals (10 men and 18 women, average age 40.32 years) with diagnosed schizophrenia, non-smokers;
III. a control group, including 29 individuals (18 men and 11 women, average age 39.07 years) with no current or past psychopathological disorders, addicted to nicotine;
IV. a control group, including 30 individuals (11 men and 19 women, average age 44.57 years) with no current or past psychopathological disorders, non-smokers.

The average age does not differentiate the study groups in a significant way. Similarly, gender does not differentiate in a significant way the groups of smokers (with schizophrenia and healthy) and non-smokers (with schizophrenia and healthy).

The schizophrenics were patients at the Clinic for Developmental Psychiatry, Psychotic Disorders and Old Age Psychiatry at the Medical University of Gdańsk, T. Bilikiewicz Hospital in Gdańsk and the Psychiatric Ward at the Specialist Hospital in Kościerzyna. All patients had diagnosed schizophrenia in accordance with the ICD-10 criteria. Each patient consented to take part in the research project.

The qualification criteria for the clinical Group I included:

- informed consent of a patient to take part in the research project, acquired before any actions related to the research procedure were undertaken;
- diagnosed schizophrenia in accordance with the ICD-10 criteria;
- nicotine addiction.

The qualification criteria for the clinical Group II included:

- informed consent of a patient to take part in the research project, acquired before any actions related to the research procedure were undertaken;
- diagnosed schizophrenia in accordance with the ICD-10 criteria;
- lack of nicotine addiction.

Healthy individuals were qualified for the study based on a purposive sampling including gender, age and addiction vs. lack of addiction to tobacco.

MATERIALS AND METHODS

Every examination was preceded by a small talk, whose purpose was to decrease the level of anxiety experienced by the respondents. All of them were familiarised with the general aim of the study and were informed that the study results would be used for scientific purposes only, and they all consented to those conditions.

Every person was examined separately; the sessions lasted from 30 minutes to 1.5 hour.

The following research methods were used in the study: (1) a self-developed questionnaire, (2) Analysis of medical records, (3) the Trail Making Test, (4) the Wisconsin Card Sorting Test, (5) the Nicotine Addiction Fagerström Test.

The study results were analysed using the IBM SPSS Statistics 17 program. The following statistical methods were used to calculate the results: (1) Spearman rho correlation analysis; (2) one-way analysis of variance (ANOVA).

The assessment of the executive functions of schizophrenics when compared to healthy individuals was important in terms of the research objectives, alongside the similar assessment of the level of executive functions of smokers vs. non-smokers in the study groups; as equally was the evaluation of the relation of cigarette smoking and the level of executive functions. These relations were analysed. In accordance with the recommendations of the creators of the methods used, I took into consideration the following: the number of trials, number of errors, the number of passed categories, the number of perseveration errors and the number of non-perseveration errors.

The results are presented in Tables 1 to 11. Table 1 contains results concerning the number of trials in the study groups, and Table 2 presents the results of variance analysis for Groups I and II (smoking and non-smoking patients) and 3 and 4 (healthy individuals: smokers and non-smokers) and the number of trials.

As can be concluded from Tables 1 and 2 above, healthy individuals, both smokers and non-smokers alike, needed a smaller number of trials to complete the task compared to both of the groups of schizophrenics. It should be pointed out that sick smoking individuals when compared to non-smokers with schizophrenia passed fewer trials in the test, which may be evidence of the better performance of the task by smokers who are ill. The analysis of the one-variable variance also proved that there exists a significant difference between the group of ill individuals and those who are healthy ($p<0.001$) with regard to the number of conducted tests.

Table 1. The number of trials in the study groups

Study group	Mean (M)	Standard deviation (SD)	N
I	119.29	17.16	31
II	124.39	7.937	28
III	107.38	22.31	29
IV	92.53	20.13	30

Explanations: I – clinical group, schizophrenics addicted to nicotine, II – clinical group, non-smoking schizophrenics, III – control group, individuals without psychopathological disorders addicted to nicotine, IV – control group, individuals without psychopathological disorders, non-smokers

Table 2. Inter-object effect tests for the dependent variable

Source	Sum of squares, type III	Df	Mean square	F	Significance	Partial Eta square
Corrected model	17757.46[a]	3	5919.15	18.63	0.001	0.329
Constant	1449145.83	1	1449145.83	4561.67	0.001	0.97
Smoking	699.14	1	699.14	2.20	0.14	0.02
Schizophrenics	14109.15	1	14109.15	44.41	0.001	0.28
Smoking * Schizophrenics	2930.61	1	2930.61	9.23	0.003	0.08

* Explanations: Smoking – yes or no, schizophrenics – occurrence or lack

For the verification of the first and the second research question, it was also important to conduct a comparison regarding the number of committed errors. In the following tables, the descriptive statistics for the study groups concerning the number of errors (Table 2), and the results of inter-object effect tests regarding the number of errors (Table 4), are presented.

The analysis of one-variable variance showed a statistical significance between the group of those ill with schizophrenia and the group of healthy individuals ($p<0.001$) also regarding the number of errors. It is equally possible to point out that the ill individuals who smoke committed fewer errors (M=57.45) in the Wisconsin Card Sorting Test in contrast to ill non-smoking individuals (M=64.36). Another correlation was noticed in the control group including healthy individuals; smoking individuals committed significantly more errors (M=38.52) than the non-smoking ones in the study group (M=23).

In Tables 4 and 5 are presented the statistics for the percentage of correct answers.

Similarly to what was the case as far as the previous indicator was concerned i.e., the number of committed errors, the analysis of the one-variable variance showed a statistical significance between the group of those ill with schizophrenia and the group of healthy individuals ($p<0.001$) with regard to the percentage of correct answers. Healthy individuals achieved a greater percentage of correct

Table 3. Descriptive statistics for the study groups concerning the number of committed errors in the study groups

Study group	Mean (M)	Standard deviation (SD)	N
I	57.45	24.30	31
II	64.36	25.31	28
III	38.52	25.28	29
IV	23.00	17.42	30

Table 4. Results of inter-object effect tests concerning the number of errors in the study groups

Source	Sum of squares, type III	Df	Mean square	F	Significance	Partial Eta square
Corrected model	30982.42[a]	3	10327.47	19.08	0.001	0.33
Constant	247505.76	1	247505.76	457.22	0.001	0.80
Smoking	26770.07	1	26770.07	49.45	0.001	0.30
Schizophrenics	546.16	1	546.16	1.01	0.32	0.01
Smoking * Schizophrenics	3702.68	1	3702.68	6.84	0.01	0.06

R square = 0.334 (corrected R square = 0.317)

Table 5. Descriptive statistics for the study groups concerning the percentage of correct answers in the study groups

Study group	Mean (M)	Standard deviation (SD)	N
I	40.13	22.14	31
II	33.71	22.74	28
III	56.97	22.20	29
IV	70.43	15.27	30

answers compared to schizophrenics. It is possible to point out as well that not only did those ill individuals addicted to tobacco commit fewer errors, but they also achieved a greater percentage of correct answers (M=40.13) compared to non-smokers with schizophrenia (M=33.72). In the case of healthy individuals, another pattern was noticed – namely, smokers achieved a lower result in this scope.

For the aim of the study, it was also important to compare the number of passed categories. The obtained results are shown in Tables 7 and 8.

The number of passed categories is the measure of success in the test and depicts the study group member's ability to discover the rules of spreading cards as changed by the researcher (Milner and Petrides, 1984; after Pąchalska, 2007). According to some of the authors (e.g. O'Donnell et al.; 1994, after Pąchalska 2008; Pachalska et al., 2013), success in test performance is the result of flexibility in the study group member's attitudes, resilience to the frustrating way of conducting the study, the ability to take advantage of previous experiences, maintain the adopted attitude and use abstract thinking. In turn, Schuep-

Table 6. Results of inter-object effect tests concerning the percentage of correct answers in the study groups

Source	Type III of square sum	Df	Mean square	F	Significance	Partial Eta square
Corrected model	24355.67[a]	3	8118.56	18.79	0.001	0.33
Constant	298246.37	1	298246.37	690.62	0.001	0.86
Smoking	21122.53	1	21122.53	48.91	0.001	0.30
Schizophrenics	366.35	1	366.35	0.85	0.36	0.01
Smoking * Schizophrenics	2911.27	1	2911.27	6.74	0.01	0.06

R square = 0.334 (corrected R square = 0.317)

Table 7. Descriptive statistics for the study groups concerning the number of passed categories in the study groups

Study group	Mean (M)	Standard deviation (SD)	N
I	3.19	1.97	31
II	2.32	2.36	28
III	4.45	1.82	29
IV	5.47	1.38	30

Table 8. Results of inter-object effect tests concerning the number of passed categories in the study groups

Source	Type III of square sum	Df	Mean square	F	Significance	Partial Eta square
Corrected model	167.51[a]	3	55.84	15.32	0.001	0.29
Constant	1753.33	1	1753.33	480.96	0.001	0.81
Smoking	142.57	1	142.57	39.11	0.001	0.26
Schizophrenics	0.16	1	0.16	0.043	0.84	0.00
Smoking * Schizophrenics	26.32	1	26.32	7.22	0.01	0.06

R square = 0.334 (corrected R square = 0.317)

bach et al. (2002) emphasize that the number of correctly arranged categories is the indicator of an ability to complete the category worked on, something that is highly correlated, above all, with the ability to develop an action plan, include new information and draw conclusions from previous experiences.

As can be concluded from the Tables above, the analysis of one-variable variation displayed a statistical significance between the group of those ill with schizophrenia and the group of healthy individuals ($p<0.001$) with regard to the number of passed categories. Healthy individuals passed more categories when compared to schizophrenics. The schizophrenics addicted to tobacco passed more categories (M=3.19) when compared to non-smokers with schizophrenia (M=2.32). This is a correlation different than that which appeared in the group of healthy individuals, and healthy smokers achieved a worse result (M=4.45) than non-smokers (M=5.47) in this scope.

In the following Tables (9 – 11), the results concerning perseveration answers and perseveration errors are included. It should be emphasized that it is those

Table 9. Descriptive statistics for the study group concerning perseveration answers and perseveration errors in the study groups

Study group	Perseveration answers		Perseveration errors		N
	Mean (M)	SD	Mean (M)	SD	
I	48.13	33.46	39.35	24.78	31
II	45.46	33.08	37.54	24.03	28
III	20.62	17.57	18.28	14.62	29
IV	13.37	11.66	12.33	10.03	30

Table 10. Results of inter-object effect tests concerning the number of perseveration answers in the study groups

Source	Type III of square sum	Df	Mean square	F	Significance	Partial Eta square
Corrected model	27310.54[a]	3	9103.51	13.71	0.001	0.26
Constant	119869.03	1	119869.03	180.48	0.001	0.616
Smoking	26164.75	1	26164.75	39.40	0.001	0.26
Schizophrenics2	724.52	1	724.52	1.09	0.29	0.01
Smoking * Schizophrenics2	155.11	1	155.11	0.23	0.63	0.002

a. R square = 0.265 (corrected R square = 0.246)

Table 11. Results of inter-object effect tests concerning the number of perseveration errors in the study groups

Source	Type III of square sum	Df	Mean square	F	Significance	Partial Eta square
Corrected model	16498.57[a]	3	5499.52	14.61	0.001	0.28
Constant	85104.42	1	85104.42	226.07	0.001	0.67
Smoking	15774.27	1	15774.27	41.90	0.001	0.27
Schizophrenics2	443.66	1	443.66	1.18	0.28	0.01
Smoking * Schizophrenics2	125.21	1	125.21	0.33	0.57	0.003

a. R square = 0.278 (corrected R square = 0.259)

very categories that many authors consider to be the most important measurements in the test.

Perseveration errors still consist in a study group member's despite of the introduction of new rules of sorting. The analysis of results concerning the number of perseveration answers and perseveration errors indicates that, even though smokers from both of the groups (healthy vs. ill) commit more perseveration errors than healthy non-smokers, the difference in means in the group of healthy non-smokers and smokers is however greater than the analogical difference in the group of ill non-smokers and smokers.

The Spearman rho correlation test was used in order to verify the research question concerning the relation between addiction to nicotine with the level of executive functions.

In the group of schizophrenics, no significant correlation between smoking cigarettes and the level of executive functions was noticed. In turn, in the case of healthy individuals, it is possible to notice that smoking has a negative impact on the number of conducted tests ($p<0.01$), the number of committed errors ($p<0.05$), the percentage of correct answers ($p<0.05$) and the number of achieved categories ($p<0.05$).

In the case of healthy individuals, there exists a correlation (at the level of $p<0.01$) between the number of smoked cigarettes and the conducted tests, the number of errors and (at the level of $p<0.05$) of answers and categories. The greater the number of cigarettes smoked daily the more negative the impact on the results achieved in these areas in the case of healthy individuals.

Likewise, there exists a correlation between the degree of addiction of healthy individuals and the number of conducted tests ($p<0.01$), the number of errors, the percentage of answers and the number of passed categories ($p<0.05$). The higher the degree of addiction, the lower the level of results achieved in the scope of the above variables.

There exists a correlation consisting in the fact that, together with addiction duration, the number of passed categories increases. In turn, in the case of healthy individuals, there exist the following correlations: together with smoking duration, the time of performing test A increases (according to norms for individuals with and without a maturity exam certificate) ($p<0.05$); the number of conducted tests is larger ($p<0.05$) as well; individuals smoking for a longer time commit more errors, their percentage of correct answers is smaller, and they pass a smaller number of categories ($p<0.05$).

The Spearman rho test was conducted for all the study groups in terms of the evaluation of results achieved in tests measuring executive functions, taking into consideration socio-demographic factors such as gender, education, age and the number of children. The results of analysis regarding the studied population of healthy individuals, smokers and non-smokers considered in its entirety are presented in Table 12.

As can be concluded from Table 12, there exists a positive relation between age and the norms for the general population for test A ($p<0.001$), the norms for

Table 12. Correlation between the level of executive functions and socio-demographic variables in the studied population of healthy individuals (Spearman rho)

Variables	Correlation	Gender	Education	Age
Norms for men	Correlation coefficient	0.13	-0.14	0.44**
	Significance (asymptotic)	0.32	0.29	0.001
Norms for men/ with and without a secondary school leaving exam certificate	Correlation coefficient	0.13	-0.12	0.46**
	Significance (asymptotic)	0.34	0.43	0.001
Norms for women	Correlation coefficient	0.37**	0.06	0.46**
	Significance (asymptotic)	0.004	0.67	0.001
Norms for women/ with and without a secondary school leaving exam certificate	Correlation coefficient	0.06	-0.04	0.53**
	Significance (asymptotic)	0.63	0.79	0.001
Raw results	Correlation coefficient	0.04	-0.17	0.46**
	Significance (asymptotic)	0.76	0.20	0.001
Raw result B	Correlation coefficient	0.16	-0.04	0.52**
	Significance (asymptotic)	0.23	0.75	0.001
Number of conducted tests	Correlation coefficient	-0.03	-0.40**	0.01
	Significance (asymptotic)	0.80	0.002	0.93
Number of errors	Correlation coefficient	0.005	-0.39**	0.02
	Significance (asymptotic)	0.970	0.002	0.87
Perseverence answers	Correlation coefficient	0.026	-0.26*	0.02
	Significance (asymptotic)	0.85	0.05	0.89
Perseveration errors	Correlation coefficient	0.03	-0.25	0.01
	Significance (asymptotic)	0.82	0.05	0.92
Percentage of answers	Correlation coefficient	-0.01	0.36**	0.03
	Significance (asymptotic)	0.92	0.01	0.80
Number of categories	Correlation coefficient	-0.07	0.30*	0.10
	Significance (asymptotic)	0.58	0.02	0.44

Schizophrenics2 = lack

individuals with and without a secondary school leaving exam certificate for test A ($p<0.001$), and the norms for the general population for test B ($p<0.001$), the raw results for test A ($p<0.001$) and the raw results for test B ($p<0.001$). A positive relation existed between gender and the norms for the general population of test B ($p<0.004$). A positive correlation with education and the percentage of correct answers ($p<0.005$) and the number of passed categories ($p<0.02$) was observed as well.

A negative relation between education and the number of conducted tests ($p<0.002$), errors ($p<0.002$), perseveration answers ($p<0.047$) and perseveration errors ($p<0.054$) was observed as well.

A similar analysis was conducted for the population of schizophrenics (non-smokers and smokers), considered in its entirety. The obtained results can be found in Table 13.

The comparison of results in Tables 12 and 13 indicates a smaller number of existing correlations between education, age and the number of children in the group of patients with schizophrenia (considered in its entirety) compared to the group of healthy individuals. Similarly to what is the case for the group of healthy individuals, in the case of those who are ill, there exists the positive correlation of age with the norms for the general population for test A, norms for individuals with and without a secondary school leaving exam certificate for test A, and the norms for individuals with and without a secondary school leaving exam certificate for test B and with the raw results for test A. Additionally, positive correlations were observed between education and the norms for individuals with and without a secondary school leaving exam certificate for test A and the norms for individuals with and without a secondary school leaving exam certificate for test B.

Statistically significant are only the results ($p<0.01$) for healthy individuals, and they are connected with test B/norms for individuals with and without a secondary school leaving exam certificate. Higher results in these tests were achieved by women. Statistically significant results are those regarding ill individuals in the case of test A/norms for individuals with and without a secondary school leaving exam certificate ($p<0.01$) and of test B/norms for individuals with and without a maturity exam certificate. That means that the higher the education level is, the more time is needed by the study group members to perform these tests, which is indicated by the lack of such data in the subject literature.

In turn, in the case of healthy individuals, there exists a correlation between education and the number of conducted tests ($p<0.01$), the higher the education level is, the faster study group members perform the test; they commit a smaller number of errors ($p<0.01$), their percentage of correct answers is larger ($p<0.05$) and they pass a greater number of categories ($p<0.05$).

In the case of the ill, there exists a correlation revealed in the fact that the older they are, the more time is needed by a study group member to perform test A/norm for the general population ($p<0.05$), test A/norm for individuals with and without a secondary school leaving exam certificate ($p<0.05$), test B/norm for individuals with and without a secondary school leaving exam certificate

Table 13. Correlation between the level of executive functions and of socio-demographical variables in the studied population of ill individuals

Variables	Correlation	Gender	Education	Age
Norms for men	Correlation coefficient	0.14	0.15	0.33*
	Significance (asymptotic)	0.30	0.26	0.01
Norms for men/ with and without a secondary school leaving exam certificate	Correlation coefficient	0.24	0.42**	0.37**
	Significance (asymptotic)	0.07	0.001	0.004
Norms for women	Correlation coefficient	-0.10	-0.11	0.22
	Significance (asymptotic)	0.45	0.42	0.10
Norms for women/ with and without a secondary school leaving exam certificate	Correlation coefficient	0.19	0.29*	0.31*
	Significance (asymptotic)	0.15	0.03	0.016
Raw result A	Correlation coefficient	0.02	0.12	0.34**
	Significance (asymptotic)	0.86	0.38	0.01
Raw result B	Correlation coefficient	-0.05	-0.13	0.17
	Significance (asymptotic)	0.71	0.34	0.21
Number of conducted tests	Correlation coefficient	-0.06	-0.004	-0.12
	Significance (asymptotic)	0.66	0.98	0.37
Number of errors	Correlation coefficient	-0.03	0.12	-0.17
	Significance (asymptotic)	0.85	0.36	0.19
Perseveration answers	Correlation coefficient	-0.04	-0.01	-0.09
	Significance (asymptotic)	0.79	0.94	0.48
Perseveration errors	Correlation coefficient	-0.04	0.003	-0.11
	Significance (asymptotic)	0.78	0.98	0.39
Percentage of answers	Correlation coefficient	0.03	-0.17	0.19
	Significance (asymptotic)	0.85	0.20	0.14
Number of categories	Correlation coefficient	-0.05	-0.10	0.17
	Significance (asymptotic)	0.70	0.47	0.21

Schizophrenics = yes

($p<0.05$) and test A/raw result ($p<0.01$). In turn, in the case of healthy individuals, there equally exists a correlation between age (the older they are, the more time is needed to perform a test) and test A/norm for the general population ($p<0.01$), test A/norm for individuals with and without a secondary school leaving exam certificate, test B/norm for the general population, test B/norm for individuals with and without a secondary school leaving exam certificate ($p<0.05$) and the raw results of test A and B ($p<0.01$). This is a pattern regarding the general population; the older one is, the lower one's level of cognitive and executive functions becomes.

As it is important for the aim of the study to concentrate on the group of schizophrenics, a correlation using the Spearman rho test regarding the number of hospitalizations and illness duration (schizophrenia) for the entire population of those ill was conducted.

The analysis of the results that was conducted using the Spearman test for the entire study group of those ill with schizophrenia indicates a positive correlation between the illness duration and the number of errors ($p=0.008$), the perseveration answers ($p=0.023$) and that of the perseveration errors committed ($p=0.015$), whereas, together with illness duration, the number of errors increases, as does the number of perseveration answers and that of the perseveration errors committed. What was also noticed, was a negative correlation between illness duration and the percentage of correct answers ($p=0.005$) as well as the number of passed categories ($p=0.032$), i.e. as illness duration increases, schizophrenics answer fewer questions correctly and pass fewer categories.

Statistical analysis using the Spearman test did not produce statistically significant results indicating the relation of the year of illness development with the norms for the general population test A, norms for individuals with and without a maturity exam certificate test A, norms for the general population test A, norms for individuals with and without a maturity exam certificate test A, the raw results of test A, the raw results of test B, the number of conducted tests, while there are no statistically significant correlations between the number of hospitalizations and the variables taken into consideration (norms for the general population of test A, norms for individuals with and without a secondary school leaving exam certificate test A, norms for the general population of test A, norms for individuals with and without a maturity exam certificate of test A, the raw results of test A, the raw results of test B, the number of conducted tests, errors, perseveration answers, perseveration errors, the percentage of correct answers and the number of passed categories).

In Table 14, a correlation with the division into groups of individuals: non-smokers and smokers (both with schizophrenia) is included.

As can be concluded from the Table above, in both of the study groups different relations exist. In the group of non-smoking schizophrenics, a positive relation between illness duration and the number of perseveration errors ($p<0.04$) and that of perseveration answers ($p<0.05$), which indicates that, together with illness duration, the number of committed errors increases, was recorded. In this group,

Table 14. Results of the significant Spearman rho correlation of analyzed variables with the number of hospitalizations and illness duration in the group of non-smokers and smokers (both with schizophrenia)

Smoking			Number of hospitalizations	Illness duration
No	Perseveration answers	Correlation coefficient	-0.12	0.37
		Significance (asymptotic)	0.56	0.05
	Perseveration errors	Correlation coefficient	-0.15	0.39*
		Significance (asymptotic)	0.46	0.04
	Percentage of answers	Correlation coefficient	0.20	-0.39*
		Significance (asymptotic)	0.32	0.04
	Number of categories	Correlation coefficient	0.12	-0.37
		Significance (asymptotic)	0.54	0.05
	Number of errors	Correlation coefficient	-0.13	0.39*
		Significance (asymptotic)	0.49	0.03
Yes	Percentage of answers	Correlation coefficient	0.07	-0.36*
		Significance (asymptotic)	0.69	0.05

there exists a negative correlation between illness duration and the percentage of correct answers ($p<0.04$) and the number of passed categories ($p<0.05$), which indicates that, together with illness duration, the percentage of correct answers and the number of passed categories decrease.

In turn, in the group of smoking schizophrenics, there exists a statistically significant positive relation between illness duration and the number of committed errors ($p<0.03$), indicating an increase in the number of committed errors together with illness duration (a similar relation was also noticed in the group of non-smoking schizophrenics) and a negative relation between illness duration and the percentage of correct answers ($p<0.04$), indicating a decrease in the percentage of correct answers together with illness duration (a similar correlation related to the previous group).

Similarly to the case of analysis for the entire group of patients with schizophrenia, also in both of the subgroups of those ill (non-smokers vs. smokers) there are no significant correlations between the number of hospitalizations and the indicators concerning executive functions.

There exists a correlation between illness duration (both in the case of non-smokers vs. smokers alike) and the number of committed errors ($p<0.01$), the percentage of perseveration answers, the number of committed errors ($p<0.05$), the percentage of correct answers ($p<0.01$) and the number of passed categories ($p<0.05$). The longer an individual has been ill, the worse the results they achieve are. That is undeniably connected with the decompensation of cognitive processes, including executive functions in the development of schizophrenics (Kępiński, 1979; Bilikiewicz, 1998).

There are no significant correlations between the level of executive functions and the number of hospitalizations. This may be connected with the beneficial impact of treatment, including pharmaceutical therapy with the use of the newest generation of drugs slowing down deficiency signs and supporting the cognitive functioning of ill individuals (Pietras, Wituski, 2011).

DISCUSSION

Healthy individuals, both smokers and non-smokers, needed a smaller number of trials to complete the task, achieved a greater percentage of correct answers and passed more categories compared to both of the groups of schizophrenics. This result is not surprising, taking into consideration clinical observations and the results of studies indicating that the symptoms of schizophrenics interfere with cognitive functioning; that fact is reflected in the conducted tests (Pawełczyk, Pawełczyk, 2007). However, important results concern differences between schizophrenics addicted to nicotine and those who are not addicted to it.

It should be pointed out that ill individuals who smoke when compared to non-smokers with schizophrenia passed fewer trials in the test, which may prove that ill smokers complete the task better; they also committed fewer errors, but also achieved a greater percentage of correct answers and passed more categories. Another correlation was noticed in the control group including healthy individuals. Smoking individuals committed significantly more errors than non-smoking study group members.

This may confirm the beneficial impact of nicotine on the attention processes of smoking patients with schizophrenia, which was the subject of papers of, inter alia, Jacobsen et al. (2004), Cattapan-Ludewig et al. (2005), Smith et al. (2006), and may prove a similarly beneficial impact on planning processes, which, in turn, is confirmed by the results of studies conducted by some authors (e.g. Everett et al., 2001). These results are confirmed by those few reports in the literature which show the specific character of influencing executive functions by nicotine in the case of that group of ill individuals, which is revealed in, inter alia, the committing of a smaller number of errors in the case of schizophrenics. In the case of individuals who do not display mental disorders such as depression or schizophrenia, the impact of nicotine on the level of executive functions is adverse, something which is unanimously confirmed by researchers (Samochowiec et al., 2001; Habrat, 2004). Deficiency of the dopaminergic mesocortical pathway, which is caused by both neurodevelopmental deficits, and, most likely, by the lack of stimulation of the corticospinal tract on the part of the glutaminergic neurons, which stimulates the mesocortical pathway, is typical of schizophrenia (Stahl, 2008). Nicotine, impacting this system, stimulates it, which improves cognitive functions (ibidem).

Passing a larger number of categories also proves the higher level of executive functions, revealed, inter alia, in abilities connected with formulating a logical concept, which is reflected in better planning skills. These results are in accordance with the results of studies conducted by Everett et al. (2001), in which performing WCST in the case of 30 patients with schizophrenia and 30 healthy individuals was compared, and it was found that those ill, even in the period of psychotic symptoms remission, still arrange significantly fewer categories when compared to individuals without psychotic disorders.

Here, it is advisable to pay attention to those results that are different than the ones obtained by me, and regarding the number of correctly arranged categories. In the studies conducted by Hintze et al. (2007), no differences in performing WCST in the scope of the number of correct categories between a group of patients with schizophrenia and a group of healthy individuals were discovered. The authors of these studies explained this by the fact that in the case of patients with schizophrenia, in spite of the existing dysfunctions in operational memory and executive functions continuing in the period of symptom remission, the effective thinking level does not have to be lowered. They pointed out that study group members were mainly treated with the new generation of neuroleptics, which do not disturb cognitive functions, and even result in their improvement, especially in the case of individuals with a short illness duration, which may be the main cause of achieving such good results within the scope of effective thinking for those patients who were members of the study groups.

The results obtained by Hintze et al. (2007) correspond with the studies of other authors who point out the beneficial impact of atypical neuroleptics on operational memory and executive functions (inter alia, Meltzer, McGurk, 1999; Rybakowski, Borkowska, 2001; Borkowska et al., 2003; Harvey et al., 2004; Rybakowski, 2010). Admittedly, individuals who smoke from both of the groups (healthy vs. ill) commit more perseveration errors than healthy non-smoking individuals, however, the difference between the means in the group of healthy individuals (non-smoking and smoking) is greater than the analogical difference in the group of sick individuals (non-smoking and smoking).

It is assumed that the most difficult part of WCST is the principle of classification by colours, whilst the rule of classification by number makes one persevere the most, and continue to spread the cards even though the rule itself is no longer valid (Granat, Berg 1948, quoting Steuden, 1992). The assessment of perseveration errors may be very difficult and controversial (cf. Flashman, Horner, Freides 1991, quoting Steuden, 1992). It is worth emphasizing that for the assessment of test performance, two different definitions of perseveration: constant perseveration and irregular perseveration, are of importance. Constant perseveration should be understood as continuing any free, but nonsensical in a given situation, activity. This activity is, therefore, an expression of inflexibility, helplessness and resistance to change. Irregular perseveration, in turn, is interpreted as a periodical (nonsensical) return to an activity (Steuden, 1992).

Perseveration errors are the characteristic symptom of schizophrenics. In the study by Everett et al. (2001), in the schizophrenics population in the remission period a greater tendency of perseveration is still existing, including the inflexibility of reactions, thinking and behaviour. The patients with schizophrenia also presented the lowered level of conceptual thinking skills. In different studies, schizophrenics also achieved results significantly lower than those of healthy individuals. Not only did they arrange significantly fewer categories in WCST, but also committed nearly twice as many perseveration errors when compared to healthy individuals (Hughes et al., 1993). Keri et al. (2001) in a study using

WCST conducted on schizophrenics after 6 months of treatment also found out that patients achieved results better than previously, however, this test was still performed less perfectly by them than by healthy individuals.

In the group of schizophrenics, insignificant correlations between smoking cigarettes and the level of executive functions were observed. In turn, in healthy individuals it is possible to observe that smoking has a negative impact on the number of conducted tests ($p<0.01$), the number of committed errors ($p<0.05$), the percentage of correct answers ($p<0.05$) and the number of achieved categories ($p<0.05$). Thus-far, results concerning the impact of nicotine on individuals without mental disorders confirm the obtained result.

There exists a correlation between illness duration (both in the case of individuals who smoke, and non-smokers) and the number of committed errors, the percentage of perseveration answers, the number of committed errors, the percentage of correct answers and the number of passed categories. The longer an individual has been ill, the worse results they achieve. This is undeniably connected with the deterioration of cognitive processes, including executive functions in the development of schizophrenics (Kępiński, 1979; Bilikiewicz, 1998). Similarly to the case for the analysis for the entire group of patients with schizophrenia, equally in both of the subgroups of patients (non-smoking vs. smoking) there are no significant correlations between the number of hospitalizations and the indications concerning executive functions. Also in the studies conducted by Hintze et al (2007) there are no statistically significant correlations with the number of hospitalizations and the performance of the Wisconsin Card Sorting Test. This may be connected with the positive impact of treatment, including pharmaceutical therapy, using the newest generation of drugs influencing a slowing down in the deficiency signs and supporting the cognitive functioning of ill individuals (Pietras & Wituski, 2011).

In future studies, one should take into consideration the type of dosage of neuroleptics taken now and previously for schizophrenics, co-morbidities, and also analyze the factors and the main sources of social support.

It is of value to incorporate in studies a larger number of individuals diverse in terms of additional sociodemographic variables, (ones not taken into consideration by me), e.g., place of residence, being employed or unemployed. I am also of the opinion that it would be good to use a greater number of methods to study executive functions.

The results obtained may also constitute a ‘voice’ in supporting psychiatrists within the national health service and other specialists working with schizophrenics to exclude psychiatric hospitals from the compulsory implementation of the Law on the Protection of Public Health Against the Effects of Tobacco Use (Journal of Laws, issue 81, position 529) of 14 May, 2010, which, although I am against smoking cigarettes, has caused a lot of harm to patients with schizophrenia and should be modified, excluding health care facilities from a ban on smoking as far as ill individuals with schizophrenia and depression are concerned. As it is mentioned in the theoretical part of this paper, there is evidence

of the therapeutic properties of nicotine through impacting disordered neurotransmitting systems: dopaminergic, serotoninergic and glutaminergic.

CONCLUSIONS

It was found that the level of executive functions in the case of schizophrenics who smoke cigarettes is higher when compared to non-smoking patients, and refers to the better results achieved on the Winconsin Card Sorting Test in: the number of conducted tests, the number of committed errors, the percentage of correct answers and the number of passed categories. The degree of addiction to nicotine in the study groups does not show a relation with the level of executive functions, however, nicotine-addiction duration has a beneficial impact on the number of passed categories in the Winconsin Card Sorting Test. No relation between the number of hospitalizations, gender and the level of executive functions of ill individuals was observed. Individuals who have had schizophrenics for a longer time commit a greater number of errors, including perseveration errors, provide a smaller percentage of correct answers and pass fewer categories. The older one is, the longer the time needed to solve the Trail Making Test A and B is. The research conducted by me was not large-scale. However, it has brought results which have confirmed, as yet scarce both in the Polish and foreign subject literature alike, reports about the beneficial impact of nicotine on executive functions in the case of the patients with schizophrenics.

REFERENCES

Bidzan, L. (2007a). Nikotyna a schizofrenia – przegląd badań. Psychiatra Polska, 5, 737-744.

Bidzan, L. (2007b). Wpływ nikotyny na leczenie neuroleptykami – przegląd badań [A review of the effects of nicotine on antipsychtic medications]. Annales Universitatis Mariae Curie-Skłodowska. Sectio D Medicina , 62, suppl. 18, 1, 226-230.

Bidzan M., Bidzan L., Pachalska M. (2014) Neuropsychiatric symptoms in patients with Alzheimer's disease with a vascular component. Ann Agric Environ Med 2014; 21(2): 412-415.

Bilikiewicz, A. (1998). Psychozy schizofreniczne [Schizophrenic psychosis]. In A. Bilikiewicz (Ed.), Psychiatria (pp. 233-255). Warszawa: PZWL.

Birchwood, M., Jackson, Ch. (2006). Schizofrenia [Schizophrenia]. Gdańsk: Gdańskie Wydawnictwo Psychologiczne.

Borkowska, A., Pilaczyńska, E., Rybakowski, J.K. (2003). The frontal lobe neuropsychological tests in patients with schizophrenia and/or obsessive-compulsive disorder. Journal of Neuropsychiatry and Clinical Neurosciences, 15, 359–362.

Breslau, N., Kilbey, M.M., Andreski, P. (1991). Nicotine dependence, major depression, and anxiety in young adults. Archives of General Psychiatry, 48,1069-1074.

Breslau, N., Kilbey, M.M., Andreski, P. (1993). Nicotine dependence and major depression: new evidence from a prospective investigation. Archives of General Psychiatry, 50, 31-35.

Cattapan-Ludewig, K., Ludewig, S., Jaquenoud Sirot, E., Etzensberger, M., & Hasler, F. (2005). Der Nervenarzt, 3, 287-94.

Dervaux, A. (2008). Tabac et schizophrénie: Aspects épidémiologiques et cliniques. L'Encéphale: Revue de psychiatrie clinique biologique et thérapeutique, 3, 299-305.

Drożak, J., Bryła, J. (2005). Dopamina – nie tylko neuroprzekaźnik [Dopamine: not just a neurotransmitter]. Postępy Higieny i Medycyny Doświadczalnej, 59, 405-420.

Everett, J., Lavoie, K., Gagnon, J.F., Gosselin, N. (2001). Performance of patients with schizophrenia on the Wisconsin Card sorting Test (WCST). Journal of Neuropsychiatry and Clinical Neurosciences, 26, 123–130.

George, T.P., Ziedonis, D.M., Feingold, A., Pepper, W.T., Satterburg, C.A., Winkel, J., Rounsaville, B.J., Kosten, T.R. (2000). Nicotine transdermal patch and atypical antipsychotic medications for smoking cessation in schizophrenia. American Journal of Psychiatry, 157, 1835-1842.

Glynn, S.H., Sussman, S. (1990). Why patients smoke. Hospital and Community Psychiatry 41, 1027-1029.

Habrat, B. (2004). Palenie tytoniu przez osoby chorujące na schizofrenię. Alkoholizm i Narkomania, 17, 3-4, 159-171.

Harvey, P.D., Green, M.F., Keefe, R.S., Velligan, D.I. (2004). Cognitive functioning in schizophrenia: a consensus statement on its role in the definition and evaluation of effective treatments for the illness. Journal of Neuropsychiatry and Clinical Neurosciences, 65, 361–372.

Hintze, B., Wciórka, J., Borkowska, A. (2007). Zaburzenia pamięci operacyjnej i funkcji wykonawczych u chorych na schizofrenię w okresie częściowej remisji objawów psychopatologicznych [Working memory and executive functions disorders in schizophrenic patients in partial remission of psychopathological symptoms]. Psychiatria, 2, 45-52.

Hughes, J.R. (1993). Possible effects of smoke-free inpatient units on psychiatric diagnosis and treatment. Journal of Clinical Psychiatry, 54,109-114.

Jacobsen, L., D'Souza, D., Mencl, W., Pugh, K., Skudlarski, P., Krystal, J. (2004). Nicotine Effects on Brain Function and Functional Connectivity in Schizophrenia. Biological Psychiatry, 8, 850-858.

Kendler, K. S., Neale, M. C., MacLean, C. L., Heath, A. C.; Eaves, L. J.; Kessler R. C. (1993). Smoking and major depression: a causal analysis. Archives of General Psychiatry, 50, 36-43.

Keri, S., Keleman, O., Benedek, G., Janka, Z. (2001). Intact prototype learning in schizophrenia. Schizophrenia Research, 52, 261–264.

Kępiński, A. (1979). Schizofrenia [Schizophrenia]. Warszawa: PZWL.

Lasser, K., Boyd, J.W., Woolhandler, S., Himmelstein, D.U., McCormick, D., Bor, D.H. (2000). Smoking and mental illness: A population-based prevalence study. Journal of American Medical Association, 284, 2606-2610.

Lyon, E. R. (1999). A Review of the Effects of Nicotine on Schizophrenia and Antipsychotic Medications. Psychiatric Services, 50, 1346-1350.

Ma, X., Li, C., Meng, H., Du, L., Wang, Q., Wang, J., Deng, W., Liu, X., Hu, X., Murray, R., Collier, D., Li, T. (2010). Premorbid tobacco smoking is associated with later age at onset in schizophrenia. Psychiatry Research, 3, 461-466.

Meltzer, H.Y., McGurk, S.R. (1999). The effect of clozapine, risperidone and olanzapine on cognitive function in schizophrenia. Schizophrenia Bulletin, 25, 233–255.

Ohara, K. (2007). The n-3 polyunsaturated fatty acid/dopamine hypothesis of schizophrenia. Progress in Neuro-Psychopharmacology & Biological Psychiatry, 2, 469-474.

Pawełczyk, A., Pawełczyk, T. (2007). Metody neuropsychologicznej oceny deficytów poznawczych w schizofrenii – przegląd narzędzi oraz wybrane aspekty kliniczne ich zastosowania. Psychiatria i Psychologia Kliniczna, 4, 182-197.

Pąchalska, M. (2007). Neuropsychologia kliniczna. Urazy mózgu [Clinical Neuropschology. Brain Injury] T. 1. Warszawa: PWN.

Pąchalska, M. (2008). Rehabilitacja neuropsychologiczna [Neuropsychological Rehabilitation]. Lublin: Wydawnictwo UMCS.

Pachalska M., Pronina M.V., Mańko G., Chantsoulis M., Mirski A., Kaczmarek B., Łuckoś M., Kropotov J.D. (2013) Evaluation of neurotherapy program for a patient with clinical symptoms of schizophrenia and severe TBI using event-related potentials. Acta Neuropsychologica 11(4) 435-450.

Pietras, T., Witusik, A. (2011). Zespół uzależnienia od nikotyny-ujęcie interdyscyplinarne [Syndrome of nicotine dependence-disciplinary approach]. Wrocław: Wydawnictwo Continuo.

Rabin, R., Sacco, K., George, T. (2009). Correlation of prepulse inhibition and Wisconsin Card Sorting Test in schizophrenia and controls: Effects of smoking status. Schizophrenia Research, 114, 91-97.

Radziwiłłowicz, W. (2010). Depresja u dzieci i młodzieży. Analiza systemu rodzinnego – ujęcie kliniczne [Depression in children and adolescents. Analysis of the family system - a clinical approach]. Kraków: Oficyna Wyd. „Impuls".

Rybakowski, J. (2010). Neuroimmunologia zaburzeń psychicznych [Neuroimmunology of mental disorders]. In J. Rybakowski, S. Pużyński, J. Wciórka (Eds.), Psychiatria. T.1 (pp. 198-209). Wrocław: Wyd. Elsevier Urban & Parker.

Rybakowski, J.K., Borkowska, A. (2001). The effect of treatment with risperidone, olanzapine or phenothiazines on cognitive functions in patients with schizophrenia. International Journal of Psychiatry in Clinical Practice, 5, 249–256.

Rzewuska, M. (2009). Układ dopaminergiczny i leki przeciwpsychotyczne [Dopaminergic system and antipsychotics]. Psychiatra w Praktyce Klinicznej, 3, 115-123.

Samochowiec, J., Rozgoziński, D., Hajduk, A., Skrzypińska, A., Arentowicz, G. (2001). Diagnostyka, mechanizm uzależnienia i metody leczenia uzależnienia od nikotyny [The diagnostics, mechanism of dependence and nicotine dependence treatment]. Alkoholizm i Narkomania, 3, 323-340.

Smith, R., Warner-Cohen, J., Matute, M., Butler, E., Kelly, E.,Vaidhyanathaswamy, S., Khan, A. (2006). Effects of nicotine nasal spray on cognitive function in schizophrenia. Neuropsychopharmacology, 3, 637-643.

Stahl, S.M. (2008). Stahl essencial psychopharmacology basis and practical applications. New York: Cambridge University Press.

Steuden, M. (1992). Test Sortowania Kart Wisconsin, interpretacja kliniczna [Wisconsin Card Sorting Test – WCST, clinical interpretation]. In S. Steuden (ED.), Wybrane zagadnienia z psychologii klinicznej (pp. 73-96). Lublin: Wyd. Norbertinum.

Ustawa o ochronie zdrowia przed następstwami używania tytoniu oraz wyrobów tytoniowych (Dz.U. 81, poz. 529) z 14 maja 2010 r.

Wciórka, J. (Ed.) (2008). Kryteria diagnostyczne według DSM-IV-TR [The diagnostic criteria according to DSM-IV-TR]. Wrocław: Wyd. Elsevier Urban &Parker.

Weiser, M., Reichenberg, A., Grotto, I. (2004). Higher rates of cigarette smoking in male adolscents before the onest of schizophrenia: a historical – prospective cohort study. American Journal of Psychiatry, 161, 1219-1223.

Williams, J.M., Foulds, J. (2007). Succesfull tobacco dependence treatment in schizophrenia. American Journal of Psychiatry, 164, 222-227.

Williams, J.M., Ziedonis, D. (2004). Adressing tobacco among individuals with a mental illness or an addiction. Addictive Behaviors, 29, 1067-1083.

Ziedonis, D.M., Kosten, T.R., Glazer, W.M., Frances, R.J. (1994). Nicotine dependence and schizophrenia. Hospital and Community Psychiatry, 45, 204-206.

Address for coresopndence:
Ilona Bidzan
Szpital Św. Wincentego a Paulo Sp. z o.o.
ul. Wójta Radtkego 1
81-348 Gdynia
e-mail: bidzan.ilona@gmail.com