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Vocational rehabilitation improves cognition and negative symptoms in schizophrenia

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ABSTRACT

Several studies in schizophrenia found a positive association between cognitive performance and work status, and it has been reported that good cognitive performance at the outset does predict the success of vocational interventions. However little has been done to investigate whether vocational interventions itself benefit cognitive performance. To test this hypothesis we performed a randomized, placebo-controlled trial to investigate in remitted schizophrenic patients the effect of a 6-months vocational rehabilitation program on cognitive performance. We recruited 112 remitted and clinically stable schizophrenic patients who aimed to enter a vocational rehabilitation program, whereas the remaining 55 were allocated to a waiting-list; the latter formed our control group, which received during the 6 months out-clinic follow-up treatment. Before and after the 6-months period we assessed changes in cognitive performance through a neuropsychological test battery, as well as changes in the psychopathological status and in quality of life. We found that vocational rehabilitation significantly improved patients' performance in cognitive measures that assess executive functions (concept formation, shifting ability, flexibility, inhibitory control, and judgment and critics abilities). Moreover, after 6 months the vocational group improved significantly in the negative symptoms and in quality of life, as compared to controls. Together with results from the literature, our findings reinforce the notion that the inclusion of vocational interventions may enhance the effectiveness of therapeutic strategies for schizophrenia patients.

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1. Introduction

Recent studies estimate that approximately 80% of the patients with schizophrenia present a significant cognitive deficit when compared to healthy persons, and this deficit may affect up to 98% of the patients when pre-morbid functioning is considered. The most replicated deficits are related to attention, mnestic and executive functions (Braff, 1993; Lysaker et al., 1995; Stip, 1996; Heinrichs and Zakzains, 1998; Poole et al., 1999; Arango et al., 1999; Adad et al., 2000; O'Carroll, 2000; Goldberg and Green, 2002; Keefe et al., 2004; Fioravanti et al., 2005). These cognitive deficits were found

to correlate with the functional outcome of schizophrenia (Green, 1996; Green and Nuechterlein, 1999; Peuskens et al., 2005; Matza et al., 2006; Leeson et al., 2009; Heinrichs et al., 2009).

Retrospective or cross-sectional studies relating schizophrenia to the work status show an association between the current work status and cognitive performance (Brekke et al., 1997; Bellack et al., 1999; Gold et al., 1999; McGurk and Meltzer, 2000; Palmer et al., 2002; Rosenheck et al., 2006), and longitudinal studies report that good cognitive performance at the outset does predict the success of vocational intervention (Bell and Bryson, 2001; Bryson and Bell, 2003; Lysaker et al., 2005; McGurk et al., 2003; McGurk and Mueser, 2006; Gold et al., 2002; Evans et al., 2004). However little has been done to investigate whether vocational interventions itself improve cognitive performance. To test this hypothesis

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we performed a randomized, placebo-controlled trial to investigate in remitted schizophrenic patients the effect of a 6-months vocational rehabilitation program on cognitive performance.

2. Methods

2.1. Subjects

The sample comprised 112 adult outpatients from the Institute of Psychiatry HC-FMUSP, with the DSM-IV diagnosis of schizophrenia (APA, 1994). Patients were included in this study aiming to enter a vocational rehabilitation program, after satisfying the following inclusion criteria:

1. Age older than 18;
2. Absence of hallucinations, delusions, thought disorder and catatonic behavior during the last 6 months;
3. Stable treatment with second-generation antipsychotic drugs during the last 6 months, with documented compliance to treatment; and
4. Unemployed during the past 12 months

Exclusion criteria were pregnancy, comorbidity with abuse or dependence of psychoactive substances and alcohol; history of convulsive crisis and neurological disorders.

After concluding the baseline neuropsychological and clinical assessments, 57 patients were randomly allocated to a vocational rehabilitation program (experimental group) and 55 were allocated to the control group, which received only out-clinic follow-up.

2.2. The vocational rehabilitation program

The vocational program consisted of a 6-months internship in one of 42 companies that signed a partnership with the Institute. Patients were allocated to each of these different establishments according to their own choices or eventually to their prior experience in the respective business activities. Patients signed with the program a “working contract”, and received from the program a “loan” which was enough to cover their transportation and meal costs during work (monthly~US\$110). The partner-companies were free from any charges and costs; we expected from them only that they accept our patients, to provide them orientation regarding the work, but without any obligations during or after the conclusion of the 6-months internship. More details on the program may be obtained from the authors.

2.3. Recruiting and assessments

The subjects were referred to our program by their psychiatrists, who were instructed to select patients in good cognitive shape, without productive symptoms, who were stable for at least 6 months on a second-generation antipsychotic drug and who were motivated to enter a vocational program. Thus, from the outset this was a highly selected sample, obviously not representative of our patients' population.

After entering the study sample, patients were thoroughly informed on the nature of the program, about their rights and

obligations during the training, and signed the Term of Informed Consent. Baseline psychopathology was assessed by a trained psychiatrist by means of the Positive and Negative Syndrome Scale (PANSS, Kay et al., 1987). Subsequently a psychologist performed the baseline neuropsychological evaluation with the following instruments: a) Digit Span (WAIS-III – Wechsler, 1997), b) Comprehension (WAIS-III – Wechsler, 1997), c) Stroop Color – Word Test (Spreen and Strauss, 1998) and d) Wisconsin Card Sorting Test – 64 cards (Spreen and Strauss, 1998), and fulfilled with the patient the Quality of Life Questionnaire (QLS, Heinrichs et al., 1984).

After these evaluations patients were randomized to the experimental or to the control group. The experimental group started the work in one of the partner companies soon after baseline evaluations. The control group entered a “waiting list” and were included in the Program's out clinic follow-up, receiving regular consultations every 4–6 weeks.

After the six months, both the experimental and the control subjects were assessed a second time with the same instruments (PANSS, neuropsychological battery and Quality of Life Questionnaire).

2.4. Statistical analysis

The continual data are represented by mean and standard deviation (SD). The nominal variations were analyzed by the Chi-square test. The normality of the distribution of continual data was assessed by the Kolmogorov–Smirnov test. For the cognitive test comparisons between the control and experimental groups at different moments, an ANOVA with repeated measures was used, with Time and Group being the factors. Differences before and after control and experimental conditions within one group were analyzed by the Friedman test. An ANCOVA was performed to correct neuropsychological results for baseline differences in the total PANSS score.

3. Results

From the 57 patients who started the vocational rehabilitation, 10 did not complete the 6-months vocational activity: 2 had a psychotic relapse, 1 had a serious pneumonia, 3 did not feel able to carry out the activity or did not adapt to the company's environment and rules, 1 went back to school, 1 received a job offer outside the Program and 2 reported feeling bad and unsettled physically after the beginning of the internship. From the 55 patients who entered the control group, 11 patients interrupted the follow-up: 4 were referred to out-clinic treatment in another institution and 7 refused to perform the second evaluation. Thus 44 controls remained in the out-clinic follow-up during at least 6 months. The vocational and the control groups, with the 91 patients that completed the 6-months period, were well matched regarding clinical and demographic variables (Table 1).

After 6 months, patients in the vocational group improved more than controls in the neuropsychological performance as assessed by the Comprehension Subtest of the WAIS-III ($p=0.014$), by the Card III of the Stroop Color Word Test ($p=0.002$), and by the items “categories” ($p=0.036$) and “non-perseverative errors” ($p=0.046$) of the Wisconsin Card Sorting Test. No significant differences between both groups were found regarding the remaining neuropsychological

Table 1
Demographic and individual characteristics of the sample.

	Control (n = 44)	Vocational (n = 47)	p
Age	30.8 ± 7.0	28.2 ± 7.8	0.100 *
Years at school	10.7 ± 2.1	11.4 ± 2.1	0.088 *
Gender (male %)	84.1	74.5	0.259 **
Governmental benefits (%)	18.2	19.1	0.906 **
Age at first treatment	21.9 ± 5.5	21.3 ± 6.0	0.618 *
Duration of the disease	10.2 ± 6.3	8.1 ± 6.0	0.134 *
Number of psychiatric hospital admissions	2.3 ± 2.5	1.9 ± 2.0	0.404 *

* t-test.

** Qui-square.

assessments (Table 2). After Bonferroni correction for multiple tests, only the difference for the Card III of the Stroop Test remained significant.

During the 6-months period both vocational and control groups improved significantly in the Digit Span Forward ($p = 0.033$) and Backward ($p = 0.006$) of the WAIS-III and in the card II of the Stroop Color Word Test ($p = 0.001$), but this improvement was not significantly different between the groups.

The General scale and the total score of the PANSS were significantly higher at baseline in the control group ($p = 0.006$; $p = 0.010$ respectively). Both scales improved significantly within each group after the 6-months period ($p = 0.003$; $p = 0.007$ respectively). However this improvement was not different between the vocational and the control groups. Baseline positive symptoms were higher in controls ($p = 0.019$), but neither controls nor vocational group showed an improvement in positive symptoms over the six months period. Conversely, the vocational group showed a higher improvement in the PANSS negative symptoms scale ($p = 0.032$) as compared to controls. Also

Table 2
Cognitive functioning, symptoms and quality of life at baseline and after the 6-months period in vocational or control groups.

Instrument	Time	Vocational (n = 47) Mean ± SD	Control (n = 44) Mean ± SD	Time $p^{(1)}$	Group $p^{(2)}$	Time × group $p^{(3)}$
<i>Wechsler Adult Intelligence Scale-III</i> ⁽¹⁾						
Digit span forward	Baseline	7.9 ± 1.9	7.3 ± 2.1	0.033	0.053	0.292
	Post	8.4 ± 2.0	7.4 ± 2.1			
Digit span backward	Baseline	4.7 ± 1.3	4.2 ± 1.4	0.006	0.150	0.052
	Post	5.3 ± 1.5	4.3 ± 1.5			
Comprehension	Baseline	12.8 ± 4.7	14.2 ± 5.0	0.001	0.699	0.014
	Post	15.1 ± 5.5	14.5 ± 5.0			
<i>Stroop Color-Word Test</i> ⁽²⁾						
Card I	Baseline	18.9 ± 6.1	19.3 ± 6.3	0.149	0.530	0.461
	Post	17.7 ± 7.5	18.9 ± 6.6			
Card II	Baseline	23.5 ± 8.0	24.0 ± 6.7	0.001	0.648	0.716
	Post	21.0 ± 11.1	22.0 ± 6.2			
Card III	Baseline	36.4 ± 14.8	35.9 ± 11.9	0.0001	0.380	0.002
	Post	30.4 ± 11.9	35.5 ± 13.1			
<i>Wisconsin Card Sorting Test</i> ⁽³⁾						
Non perseverative errors	Baseline	14.0 ± 9.1	14.1 ± 7.0	0.008	0.198	0.046
	Post	10.3 ± 5.9	13.5 ± 6.4			
Perseverative errors	Baseline	12.5 ± 7.4	14.0 ± 6.2	0.444	0.224	0.955
	Post	12.0 ± 6.3	13.5 ± 6.4			
Total categories	Baseline	2.0 ± 1.3	1.8 ± 1.2	0.134	0.088	0.036
	Post	2.4 ± 1.3	1.8 ± 1.2			
<i>Positive and Negative Syndrome Scale</i>						
Positive scale	Baseline	9.2 ± 2.4	10.6 ± 2.6	0.529	0.019	0.224
	Post	8.5 ± 1.9	12.7 ± 15.0			
Negative scale	Baseline	17.0 ± 4.4	15.9 ± 5.5	0.144	0.933	0.032
	Post	15.3 ± 4.1	16.2 ± 5.8			
General scale	Baseline	23.5 ± 10.7	27.1 ± 7.7	0.003	0.006	0.093
	Post	20.4 ± 7.5	26.2 ± 7.4			
Total score	Baseline	49.7 ± 14.2	53.7 ± 12.1	0.007	0.010	0.065
	Post	44.6 ± 9.7	52.8 ± 12.4			
Quality of life – QLS	Baseline	72.4 ± 14.8	65.8 ± 19.2	0.0001	0.015	0.036
	Post	80.7 ± 16.6	69.2 ± 21.5			

Repeated measures ANOVA with Group and Time as factors:

$p^{(1)}$ Changes within groups between baseline and post 6 months.

$p^{(2)}$ Comparison between-groups of the mean values at baseline and after 6 months.

$p^{(3)}$ Comparison between the groups of the changes baseline-after 6 months (interaction time × group).

Units of neuropsychological measurements:

(1) = number of correct answers.

(2) = time to complete the task.

(3) = number of errors.

regarding the quality of life scale, improvement after 6 months was higher in the vocational group as compared to controls ($p=0.036$). After ANCOVA correcting for the increased baseline PANSS in the control group, differences in cognitive improvement after 6 months remained significant for WAIS-III Digit Span Backward ($p=0.025$) and Comprehension ($p=0.015$), as well as for the Card III of the Stroop Test ($p=0.001$).

4. Discussion

We found that vocational rehabilitation significantly improved patients' performance in cognitive measures that assess executive functions (concept formation, shifting ability, flexibility, inhibitory control, and judgment and critics abilities). To our knowledge, this is the first longitudinal study of the effects of vocational rehabilitation on cognitive performance in schizophrenic patients.

Rosenheck et al. (2006) evaluated in more than 1400 schizophrenic patients the factors associated to participation in the work market. The participation in competitive and non competitive employment, when compared to the unemployed group, was associated with fewer severe symptoms and better cognitive functioning. In contrast, Gold et al. (2002) found no difference in cognitive performance between employed ($n=40$) and unemployed schizophrenic patients ($n=110$).

McGurk and Meltzer (2000) studied 30 patients with schizophrenia and with stable vocational functioning in the past year. They found that patients who worked full time (more than 30 h weekly) had in general a better cognitive performance than the unemployed patients. The patients who worked full time showed also superior performance in working memory, vigilance and executive functioning measures, than patients who worked half time (less than 30 weekly hours). These authors raised the hypothesis that work may have improved the cognitive performance, as upon using the cognitive abilities at work, they can be strengthened. However, by the very cross-sectional nature of these studies, no conclusion could be drawn as to whether the superior cognitive performance in the employed groups was at least partly a result of the working itself.

The results of our longitudinal study support the hypothesis advanced by McGurk and collaborators (McGurk and Meltzer, 2000; McGurk and Mueser, 2004), suggesting that working does contribute to the improvement of cognition in schizophrenia patients. In a more recent work, McGurk et al. (2009) reported that the addition of cognitive training to vocational rehabilitation improved both cognitive functioning and employment outcomes in individuals with severe mental illness. Interestingly however, in this study McGurk et al. also found some cognitive improvement in the control group, which did not receive cognitive training but participated in a vocational rehabilitation during 3 months. This finding is in line with our present results and reinforce the notion that employment programs may be a useful tool for the cognitive rehabilitation of schizophrenia and possibly other severely ill persons.

McGurk and Mueser (2004) hypothesized that supported employment services improve positive symptoms, but may be unable to improve negative symptoms, because the latter include diminished motivation to follow through on personal

goals, including thus limited motivation to work itself. In the present study, one of the inclusion criteria was the absence of positive symptoms, so that under our experimental conditions an effect of work on positive symptoms could not be expected. However, we did find in our sample a significant improvement in negative symptoms after the 6-months vocational rehabilitation. Negative symptoms, as assessed by the PANSS, comprehend a relatively broad variety of manifestations. Beside motivational aspects, a close relationship has been described between negative symptoms and cognitive functioning in schizophrenia (review in Bora et al., 2009). We speculate thus, that in our sample the observed improvement in negative symptoms was, at least in part, associated to the improvement in cognitive functioning.

As to quality of life, our vocational rehabilitation group presented a significant improvement after six months as compared to controls. This is in line with the findings that unemployed schizophrenia patients are less satisfied with the quality of life than those who are employed (Chan and Yu, 2004) and that the quality of life is consistently increased by interventions that promote vocational functioning (Bond et al., 2001; Torrey et al., 2000; Van de Willige et al., 2005; Fiszdon et al., 2008).

It should be stressed that we investigated a sample of highly selected schizophrenia patients: they were remitted and stable for at least 6 months, and were considered by their psychiatrists as in good shape to succeed in a vocational rehabilitation program. Moreover, all patients were in treatment with second-generation antipsychotics (SGA), since some data points to superiority of the SGA in a series of cognitive domains, such as the executive functions (Keefe et al., 1999; Meltzer and McGurk, 1999; Woodward et al., 2005; Burton, 2006; Riedel et al., 2010). Thus, our sample obviously was not representative of the populations of schizophrenic patients who attend our service. However, the clinical and cognitive selection criteria, as well as treatment with SGA, were inclusion conditions for both experimental and control groups. Therefore, they cannot explain differences between the groups observed in the present study.

Obviously our results should be seen with caution, as the differences between experimental and control groups were reduced after Bonferroni correction for type I errors. Moreover, we cannot rule out that a learning effect after test–retest occurred in our sample. However, this effect after 6 months is likely to be modest and to affect similarly both experimental and control groups. Thus, our findings reinforce the notion that the inclusion of vocational interventions may enhance the effectiveness of therapeutic strategies for schizophrenia patients. However, in face of the methodological and statistical limitations discussed above, we think that further studies with larger samples are needed to confirm the present results.

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Contributors

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Conflict of interest

None.

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References

- Adad, M.A., Castro, R., Mattos, P., 2000. Aspectos Neuropsicológicos da esquizofrenia. *Rev. Bras. Psiquiatr.* 22, 31–34.
- American Psychiatric Association—APA, 1994. *Diagnostic and Statistical Manual Of Mental Disorders*, 4th edition. Washington, DC.
- Arango, C., Bartko, J.J., Gold, J.M., Buchanan, R.W., 1999. Prediction of neuropsychological performance by neurological signs in schizophrenia. *Am. J. Psychiatry* 156, 1349–1357.
- Bell, M., Bryson, G., 2001. Work rehabilitation in schizophrenia: does cognitive impairment limit improvement? *Schizophr. Bull.* 27 (2), 260–279.
- Bellack, A.S., Gog, J.M., Buchanan, R.W., 1999. Cognitive rehabilitation for schizophrenia: problems, prospects, and strategies. *Schizophr. Bull.* 25 (2), 257–274.
- Bond, G.R., Resnick, S.G., Drake, R.E., Xie, H., McHugo, G.J., Bebout, R.R., 2001. Does competitive employment improve nonvocational outcomes for people with severe mental illness? *J. Consult. Clin. Psychol.* 69 (3), 489–501.
- Bora, E., Yucel, M., Pantelis, C., 2009. Cognitive functioning in schizophrenia, schizoaffective disorder and affective psychoses: meta-analytic study. *Br. J. Psychiatry* 195, 475–482.
- Braff, D.L., 1993. Information processing and attention dysfunctions in schizophrenia. *Schizophr. Bull.* 19, 233–259.
- Brekke, S.J., Raine, A., Ansel, M., Lencz, T., Bird, L., 1997. Neuropsychological and psychophysiological correlates of psychosocial functioning in schizophrenia. *Schizophr. Bull.* 23 (1), 19–28.
- Bryson, G., Bell, M., 2003. Initial and final work performance in schizophrenia: cognitive and symptom predictors. *J. Nerv. Ment. Dis.* 191, 87–92.
- Burton, S., 2006. Symptom domains of schizophrenia: the role of atypical antipsychotic agents. *J. Psychopharmacol.* 20 (6 Suppl), 6–19.
- Chan, S., Yu, I.W., 2004. Quality of life of clients with schizophrenia. *J. Adv. Nurs.* 45 (1), 72–83.
- Evans, J.D., Bond, G.R., Meyer, P.S., Kim, H.W., Lysaker, P.H., Gibson, P.J., Tunis, S., 2004. Cognitive and clinical predictors of success in vocational rehabilitation in schizophrenia. *Schizophr. Res.* 70, 331–342.
- Fioravanti, M., Carlone, O., Vitale, B., Cinti, M.E., Clare, L., 2005. A meta-analysis of cognitive deficits in adults with a diagnosis of schizophrenia. *Neuropsychol. Rev.* 15, 73–95.
- Fiszdon, J.M., Choi, J., Goulet, J., Bell, M.D., 2008. Temporal relationship between change in cognition and change in functioning in schizophrenia. *Schizophr. Res.* 105 (1–3), 105–113.
- Gold, J.M., Queern, C., Iannone, V.N., Buchanan, R.W., 1999. Repeatable battery for the assessment of neuropsychological status as a screening test in schizophrenia I: sensitivity, reliability, and validity. *Am. J. Psychiatry* 156 (12), 1944–1950.
- Gold, J.M., Goldberg, R.W., McNary, S.W., Dixon, L.B., Lehman, A.F., 2002. Cognitive correlates of job tenure among patients with severe mental illness. *Am. J. Psychiatry* 159, 1395–1402.
- Goldberg, T.E., Green, M.F., 2002. Neurocognitive Functioning in Patients with Schizophrenia: An Overview. In: Davis, K.L., Charney, D., Coyle, J.T., Nemeroff, C. (Eds.), *Neuropsychopharmacology: the fifth generation of progress*. Lippincott Williams & Wilkins, pp. 657–669.
- Green, M.F., 1996. What are the functional consequences of neurocognitive deficits in schizophrenia? *Am. J. Psychiatry* 153, 321–330.
- Green, M.F., Nuechterlein, K.H., 1999. Should schizophrenia be treated as a neurocognitive disorder? *Schizophr. Bull.* 25, 309–319.
- Heinrichs, R.W., Zakzains, K.K., 1998. Neurocognitive deficit in schizophrenia: a quantitative review of the evidence. *Neuropsychology* 12, 426–445.
- Heinrichs, D.W., Hanlon, T.E., Carpenter Jr, W.T., 1984. The Quality of Life Scale: an instrument for rating the schizophrenic deficit syndrome. *Schizophr. Bull.* 10, 388–398.
- Heinrichs, R.W., Ammari, N., Miles, A., Vaz, S.M.D., Chopov, B., 2009. Psychopathology and cognition in divergent functional outcomes in schizophrenia. *Schizophr. Res.* 109, 46–51.
- Kay, S.R., Fiszbein, A., Opler, L.A., 1987. The positive and negative syndrome scale for schizophrenia. *Schizophr. Bull.* 13, 261–276.
- Keefe, R.S.E., Silva, S.G., Perkins, D.O., Lieberman, J.A., 1999. The effects of atypical antipsychotic drugs on neurocognitive impairment in schizophrenia: a review and meta-analysis. *Schizophr. Bull.* 25, 201–222.
- Keefe, R.S., Goldberg, T.E., Harvey, P.D., Gold, J.M., Poe, M.P., Coughenour, L., 2004. The brief assessment of cognition in schizophrenia: reliability, sensitivity, and comparison with a standard neurocognitive battery. *Schizophr. Res.* 68 (2–3), 283–297.
- Leeson, V.C., Barnes, T.E.R., Hutton, S.B., Ron, M.A., Joyce, E.M., 2009. IQ as a predictor of functional outcome in schizophrenia: a longitudinal, four-year study of first-episode psychosis. *Schizophr. Res.* 107 (1), 55–60.
- Lysaker, P.H., Bell, M.D., Beam-Goulet, J., 1995. Wisconsin card sorting test and work performance in schizophrenia. *Psychiatry Res.* 56, 45–51.
- Lysaker, P.H., Bryson, G.J., Davis, L.W., Bell, M.D., 2005. Relationship of impaired processing speed and flexibility of abstract thought to improvements in work performance over time in schizophrenia. *Schizophr. Res.* 75, 211–218.
- Matza, L.S., Buchanan, R., Purdon, S., Brewster-Jordan, J., Zhao, Y., Revicki, D.A., 2006. Measuring changes in functional status among patients with schizophrenia: the link with cognitive impairment. *Schizophr. Bull.* 32 (4), 666–678.
- McGurk, S.R., Meltzer, H.Y., 2000. The role of cognition in vocational functioning in schizophrenia. *Schizophr. Res.* 27;45 (3), 175–184.
- McGurk, S.R., Mueser, K.T., 2004. Cognitive functioning, symptoms, and work in supported employment: a review and heuristic model. *Schizophr. Res.* 70, 147–173.
- McGurk, S.R., Mueser, K.T., 2006. Cognitive and clinical predictors of work outcomes in clients with schizophrenia receiving supported employment services: 4-year follow-up. *Adm. Policy Ment. Health Ment. Health Serv. Res.* 33, 598–606.
- McGurk, S.R., Mueser, K.T., Harvey, P.D., LaPuglia, R., Marder, J., 2003. Cognitive and symptom predictors of work outcomes for clients with schizophrenia in supported employment. *Psychiatr. Serv.* 54, 1129–1135.
- McGurk, S.R., Mueser, K.T., DeRosa, T.J., Wolfe, R., 2009. Work, recovery, and comorbidity in schizophrenia: a randomized controlled trial of cognitive remediation. *Schizophr. Bull.* 35 (2), 319–335.
- Meltzer, H.Y., McGurk, S.R., 1999. The effect of clozapine, risperidone, and olanzapine on cognitive function in schizophrenia. *Schizophr. Bull.* 25, 233–255.
- O'Carroll, R., 2000. Cognitive impairment in schizophrenia. *Adv. Psychiatr. Treat.* 6, 161–168.
- Palmer, B.W., Heaton, R.K., Gladsjo, J.A., Evans, J.D., Patterson, T.L., Golshan, S., Jeste, D.V., 2002. Heterogeneity in functional status among older outpatients with schizophrenia: employment history, living situation, and driving. *Schizophr. Res.* 55, 205–215.
- Peuskens, J., Demily, C., Thibaut, F., 2005. Treatment of cognitive dysfunction in schizophrenia. *Clin. Ther.* 27 (Suppl A), S25–S37.
- Poole, J.H., Ober, B.A., Shenaut, G.K., Vinogradov, S., 1999. Independent frontal-system deficits in schizophrenia: cognitive, clinical, and adaptive implications. *Psychiatry Res.* 85, 161–176.
- Riedel, M., Schennach-Wolff, R., Musil, R., Dehning, S., Ceroveck, A., Oppen-Rhein, M., Matz, J., Seemüller, F., Obermeier, M., Severus, E., Engel, R.R., Müller, N., Möller, H.J., 2010. Effect of aripiprazole on cognition in the treatment of patients with schizophrenia. *Pharmacopsychiatry* 43 (2), 50–57.
- Rosenheck, R., Leslie, D., Keefe, R., McEvoy, J., Swartz, M., Perkins, D., Stroup, S., Hsiao, J.K., Lieberman, J., 2006. CATIE Study Investigators Group. Barriers to employment for people with schizophrenia. *Am. J. Psychiatry* 163, 411–417.
- Spreen, O., Strauss, E., 1998. *A Compendium of Neuropsychological Tests*. Oxford University Press, Oxford.
- Stip, E., 1996. Memory impairment in schizophrenia: perspectives from psychopathology and pharmacotherapy. *Can. J. Psychiatry* 41, 275–345.
- Torrey, W.C., Mueser, K.T., McHugo, G.H., Drake, R.E., 2000. Self-esteem as an outcome measure in studies of vocational rehabilitation for adults with severe mental illness. *Psychiatr. Serv.* 51 (2), 229–233.
- van de Willige, G., Wiersma, D., Nienhuis, F.J., Jenner, J.A., 2005. Changes in quality of life in chronic psychiatric patients: a comparison between EuroQol (EQ-5D) and WHOQoL. *Qual. Life Res.* 14 (2), 441–451.
- Wechsler D. (1997). *WAIS III: Escala de Inteligência Wechsler para Adultos*. Adaptação e padronização de uma amostra brasileira – Elizabeth do Nascimento. São Paulo: Casa do Psicólogo, 2004.
- Woodward, N.D., Purdon, S.E., Meltzer, H.Y., Zald, D.H., 2005. A meta-analysis of neuropsychological change to clozapine, olanzapine, quetiapine, and risperidone in schizophrenia. *Int. J. Neuropsychopharmacol.* 8 (3), 457–472.