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The Effect of Vocational Rehabilitation on Neurocognitive Function in Patients with Chronic Schizophrenia: A Prospective Study

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ABSTRACT

Research indicates that people with schizophrenia or schizoaffective disorder have a high rate of unemployment, compared with other forms of disability. Token economy program in vocational rehabilitation are found to be effective in improving the cognitive function of patients with chronic schizophrenia. The present study aimed to examine the effect of vocational rehabilitation on neurocognitive function of the patient. This was a hospital based longitudinal study done at Central Institute of Psychiatry, Ranchi and purposive sampling was used. The sample consisted of 15 patients with chronic schizophrenia according to ICD-10 DCR criteria. After taking informed consent from the patient, Socio-demographic and clinical data sheet, Eysenck's Series of Digit Span Test, Bender Visual Motor Gestalt Test, Porteus Maze Test, Trail Making Task, Wisconsin Card Sorting Test, Stroop Colour- Word Test, were administered for all the patients (Pre and Post intervention) After that the patient's were involved in the vocational rehabilitation training, for six months in the book binding section of sheltered workshop situated in CIP. Data was analyzed with the help of discrete and continuous variables. Paired't' test was used to see the efficacy of intervention. Result showed that vocational rehabilitation significantly improved patient's performance in Attention, visual motor coordination, planning, psychomotor speed, set shifting and cognitive flexibility. The patient all learned the skill of book binding during the 6 months. Token economy based on the principles of operant conditioning improved the patient's behaviour; patients were more cooperative, adaptive, attitude towards other patients improved, responsible and punctual. All patients responded well to the positive reinforcement showing the efficacy of token economy procedures and the success rate of vocational rehabilitation.

Key Words: Schizophrenia, Vocational Rehabilitation, Executive function, Token economy

INTRODUCTION

Research indicates that people with schizophrenia or schizoaffective disorder have a high rate of unemployment, compared with other forms of disability (Andrew et al., 1992). Vocational rehabilitation such as sheltered workshops provides an enclave type of work environment where every worker has a disability. The work is usually repetitive and monotonous, and the jobs are time-unlimited. Working in a sheltered setting, where their work met contract obligations while their own personal growth or vocational satisfaction was never a consideration. After all they were working and that was the ultimate goals of the vocational rehabilitation therapist in charge of the case.

Token economy program in vocational rehabilitation are found to be effective in patients with chronic schizophrenia (Ayllon & Azrin, 1965). Marks et al. (1968) evaluated 22 patients with chronic schizophrenia and the desirable behaviour was rewarded with poker chips exchangeable for meals. It has been shown that token economy improves the patient's behaviour. Cognitive impairment is common in schizophrenia and is evident in a broad range of domains such as attention, memory, executive functioning and information processing speed (Gold et al., 1993; Saykin et al., 1994). Furthermore, in a study by Bio & Gattaz (2011) examined 57 patients on vocational rehabilitation program for 6 months, the results showed that, significant improvement in their neuropsychological performance of stroop colour word test, and by the items categories and non perseverative errors of the Wisconsin card sorting test, and also improved significantly in digit span backward and forward. Similarly, Kumar (2008) observed 34 patients with chronic schizophrenia; the study proves that vocational rehabilitation for 6 months enhances cognitive functioning in patients with chronic schizophrenia. Therefore vocational rehabilitation shows a significant improvement in cognition, and

negative symptoms (Mueser et al., 1997). However, Lehman (1995) detailed that we can state with moderate confidence that vocational rehabilitation programs by definition enhance the vocational activities of persons with psychiatric disabilities while patients are in these programs, but that they do not have significant effects on rates of competitive employment after leaving the programs. There is a trend that improvements in vocational functioning are correlated with improvements in other outcomes, such as reduced symptoms and improves cognitive function, but it is not clear that there is any causal relationship between this correlation and vocational rehabilitation interventions. Therefore the present study aimed to examine the effect of vocational rehabilitation on the Neuro-cognitive function of chronic schizophrenia. The specific objectives of this study were:

- To find out the effect of vocational rehabilitation on executive function, attention and visual motor function of the patient.

METHOD

Sample:

This was a hospital based longitudinal study done at Central Institute of Psychiatry, Ranchi and purposive sampling was used. The sample consisted of 15 patients with chronic schizophrenia fulfilling the inclusion and exclusion criteria.

Inclusion Criteria

- Those who fulfilled the ICD-10 (DCR) criteria for Schizophrenia with duration of 2 or more years (working definition for the purpose of study)
- Age range between 35 to 65 years.
- Stable treatment with antipsychotic drugs during the last 6 months.
- Male Inpatients admitted for ≥ 6 months.

Exclusion Criteria

- Dependence on psychoactive substance and alcohol, except nicotine and caffeine
- History of seizures, Mental retardation
- Auditory and visual impairment

Description of the Tools:
Socio Demographic and clinical Data Sheet:

A socio demographic and clinical data sheet was specifically designed for the study to record relevant details of each case. The semi-structured Performa contained socio-demographic characteristics and the clinical characteristics.

Eysenck's Series of Digit Span Test (Pershad et al., 1989):

This test is a part of PGI battery of brain dysfunction. It consist two parts digit forward and digit backward. It measures attention and concentration.

The Bender Visual Motor Gestalt Test (Pascal et al., 1951):

The test measure perception and visual motor functioning. The bender-gestalt test consist of nine simple designs, each which is presented to a subject for him to copy on a sheet of paper.

Porteus Maze Test (Porteus, 1965):

It is the test of planning. This consists of a number of pencil and paper maze problems graded in difficulty from year III to adult problems.

Trail Making Test (Reitan et al., 1958):

The trail making test is a neuropsychological test of psychomotor (speed visual search and motor speed) and cognitive flexibility. The test has two parts. Part A in which the targets are all numbers (1, 2, 3, etc.) and B, in which the subjects alternates between numbers and letters (1, A, 2, B, etc)

Wisconsin Card Sorting Test (Heaton et al., 1993):

The Wisconsin card sorting test (WCST) is a test to assess abstract reasoning ability, set shifting and concept formation. It consists of four stimulus cards and 128 response cards that depict figures of varying form, colours and numbers.

Stroop Colour - Word Test (Golden, 2002):

The Stroop colour word test measures executive functioning in response inhibition. It consist three pages word, colour and colour- word, each page has 100 items. The subjects need to read each page as quickly as possible. The subject should allow 45 seconds for each page.

STATISTICAL ANALYSIS

Statistical analyses were done using appropriate statistics from the statistical package for social sciences (SPSS) 16.0. Descriptive statistics used for analyzing discrete and continuous variables. We have checked the data for normality and applied paired't' test to see the efficacy of intervention

RESULTS

Table 1: Shows Socio Demographic Characteristics of the patient group (N=15)

Variable		Mean ± SD/ n(n%)	Range
Age (years)		52.13±8.67	39-63
Education (years)		10.80±2.43	6-17
Duration of Illness (years)		22.53±7.11	10-32
Age of Onset (years)		28.27±4.76	20-40
Age at first hospitalization (years)		31.00±5.52	19-42
Duration of continuous stay in hospital (years)		19.73±7.15	9-30
Marital status	**Married**	4 (26.7)	
	Unmarried	11 (73.3)	
Religion	**Hindu**	15 (100)	
Diagnosis	**Residual Schizophrenia**	15 (100)	

Table 1 shows descriptive statistics of socio demographic and clinical variables. Mean age of the patient group was found to be 52.13±8.67 years. It was seen that mean years of education was 10.80±2.43 years, duration of illness was 22.53±7.11 years, age of onset was 28.27±4.76 years, age at first hospitalization was 31.00±5.52 years and duration of continuous stay in hospital was 19.73±7.15 years.

Table 2: Comparison of pre and post scores of Eysenck's Series of Digit Span Test (ESDST) in schizophrenia patient group (N=15)

	Pre-Intervention	Post-Intervention	t	df	p
	Mean ± SD	Mean ± SD			
ESDST-DF	4.40±1.056	5.13±0.74	4.78	14	.000***
ESDST-DB	3.20±0.94	4.20±0.68	4.58	14	.000***

***p<.001

Table 2 shows comparison of pre and post scores of ESDST-digit forward and backward in schizophrenia patient group using paired samples t test. Post scores of ESDST- digit forward were significantly higher (p<.001) than the pre scores. It was seen that post scores of ESDST- digit backward were significantly higher (p<.001) than the pre scores.

Table-3 Comparison of pre and post scores of Bender Gestalt Test in schizophrenia patient group (N=15)

	Pre-Intervention	Post-Intervention	t	df	p
	Mean ± SD	Mean ± SD			
Bender Gestalt Test	9.40±4.94	5.87±4.73	4.57	14	.000***

***p<.001

Table 3 shows comparison of pre and post scores of bender gestalt test in schizophrenia patient group using paired samples t test. Post scores of bender gestalt test were significantly lower (p<.001) than the pre scores.

Table: 4 Comparison of pre and post scores of STROOP-TEST in schizophrenia patient group (N=15)

	Pre- Intervention	Post-Intervention	t	df	p
	Mean ± SD	Mean ± SD			
Stroop –Word	49.80±15.38	55.20±12.47	2.09	14	.056

Stroop-Colour	26.80±7.45	32.87±6.99	5.26	14	.000***
Stroop-Colour Word	14.73±7.01	19.40±7.52	4.61	14	.000***

***p<.001

Table 4 shows comparison of pre and post scores of stroop-test in schizophrenia patient group using paired samples t test. Post scores of stroop-colour were significantly higher (p<.001) than the pre scores. Post scores of stroop–colour word were significantly higher (p<.001) than the pre scores.

Table 5: Comparison of pre and post scores of Wisconsin Card Sorting Test (WCST) scores in schizophrenia patient group (N=15)

	Pre-Intervention	**Post-Intervention**	**t**	**df**	**p**
	Mean ± SD	**Mean ± SD**			
WCST total number correct	36.33±7.09	51.47±13.45	5.11	14	.000***
WCST total number error	91.67±7.09	76.53±13.45	5.11	14	.000***
WCST perseverative response	64.73±47.50	74.33±38.88	0.77	14	.456
WCST perseverative error	51.33±33.79	58.20±27.32	0.76	14	.458
WCST non perseverative error	40.33±33.28	18.93±15.18	2.60	14	.021*
WCST conceptual level response	11.60±6.00	27.20±15.37	4.01	14	.001**
WCST -number of categories completed	0.20±0.56	1.00±1.07	2.86	14	.013*

***p<.001 **p<.01 *p<.05

Table 5: shows comparison of pre and post scores of WCST in schizophrenia patient group using paired samples t test**.** Post scores of WCST total number correct were significantly higher (p<.001) than the pre scores. Post scores of WCST total number error were significantly lower (p<.001) than the pre scores. Post scores of WCST non perseverative error were significantly lower (p<.05) than the pre scores. Post scores of WCST conceptual level response were significantly higher (p<.01) than the pre scores. Post scores of WCST-number of categories completed were significantly higher (p<.05) than the pre scores. There was no significant difference in WCST perseverative response and WCST perseverative error.

Table-6: Comparison of pre and post scores of Porteus Maze Test in schizophrenia patient group (N=15)

	Pre-Intervention	**Post-Intervention**	**T**	**df**	**p**
	Mean ± SD	**Mean ± SD**			
Porteus-Maze Test	7.20±2.62	9.33±3.06	3.55	14	.003**

**p<.01

Table 6 shows comparison of pre and post scores of porteus maze test in schizophrenia patient group using paired samples t test. Post scores of porteus maze test were significantly higher (p<.01) than the pre scores.

Table-7: Comparison of pre and post scores of Trail Making Test in schizophrenia patient group (N=15)

	Pre-Intervention	**Post-Intervention**	**T**	**df**	**p**
	Mean ± SD	**Mean ± SD**			
Trail Making Test-Total Time Part-A	180.5±109.34	91.60±36.01	3.41	14	.004**
Trail Making Test-Total Time Part-B	381.87±199.32	203.60±87.47	3.38	14	.004**

**p<.01

Table 7 shows comparison of pre and post scores of trail making test-total time Part-A in schizophrenia patient group using paired samples t test. Post scores of trail making test-total time Part-A were significantly lower (p<.01) than the pre scores. Post scores of trail making test-total time Part-B were significantly lower (p<.01) than the pre scores.

DISCUSSION

The present study found that vocational rehabilitation significantly improved patient's performance in attention. These findings are in consistent with previous research by Greig et al. (2007) showed improvement in patients attention span after vocational rehabilitation. Additionally, Kumar (2008) also reported improvement in patient's attention span after 6 months of vocational rehabilitation. Similarly, Bio & Gattaz (2011) studied 112 patients with schizophrenia enrolled in a vocational rehabilitation program for 6 months and reported significant improvement in attention. This effect can be

explained by the fact that, work requires people to concentrate on the tasks at hand while blocking out any distressing thoughts (Di Masso et al., 2001). In contrast Vauth et al. (2005) reported no improvement in the attention of the patients with schizophrenia following vocational rehabilitation.

The current study observed that vocational rehabilitation significantly improved patient's performance in visual motor coordination. These findings are in accordance with previous research by Kumar (2008) showed improvement in patients visual motor coordination. In another study by Keehn (1957) evaluated 4 patients with chronic schizophrenia and documented improvement in visual motor coordination as measured by bender gestalt test, after 2 months of rehabilitation. A possible understanding for this effect is that performance can be enhanced on a range of cognitive tasks through practice, instruction, and provision of incentives (Bellack, 1999).

The present study showed improvement in stroop colour scores and stroop colour word scores. These findings are in accordance with the earlier research (Bell & Bryson 2001). We also found significant improvement in non perseverative errors, categories complete and conceptual level in WCST, these findings are in accord with Greig et al. (2007) showed significantly greater gains in categories complete and conceptual level on the WCST. Similarly, Bio & Gattaz (2011) reported improvement in Stroop colour word test and also improvement in categories and non-perseverative errors of wisconsin card sorting test. Additionally, Srinivasan & Tirupati (2005) also reported similar findings of better WCST non perseverative errors in employed patients. The present findings suggest that these cognitive abilities may be important to employment outcomes. In addition, the compensatory nature of the vocational rehabilitation program may lessen or ameliorate the negative impact of the cognitive deficits seen in schizophrenia. It may be that once an individual obtains a vocational placement, aspects of work behaviour determine job tenure and maintenance. In our study we found that there is no improvement in perseverative error with rehabilitation. These finding are consistent with the findings of Lysaker et al. (1995). Perhaps, the lack of significance indicates that organic impairments linked to occupational function are not related to frontal deficits but to diffuse global impairment instead.

The present study also found that vocational rehabilitation significantly improved patient's performance in planning. These findings are consistent with previous research (McGurk & Melter, 2000; Mueser et al., 2001; Racenstein et al., 2002) which supports the improvement of planning abilities in vocational rehabilitation. One possible explanation for better planning can be the passive lifestyle in which the hospital staffs make decisions regarding their daily life; the patients who underwent transition experienced a dramatic change to an active lifestyle, in which they were expected to solve their own problems and to make decisions by themselves (Nemoto et al., 2014). In contrast Vauth et al. (2005) reported there is no improvement in planning ability of the patients. In another study by Wykes et al. (2003b) found mixed results with respect to planning ability reported positive effects on modified six elements and no effects on Tower of London. One possible explanation could be that, the tool they have used to measure planning ability (Tower of Hanoi) was not sensitive to changes in everyday planning (Vauth et al., 2008).

In this study we found that vocational rehabilitation significantly improved patient's performance in psychomotor speed. These findings are consistent with previous research (McGurk & Mueser, 2003) found that employed participant with schizophrenia have better psychomotor speed than unemployed. In another study by Abi Saab et al. (2005) reported improvement in psychomotor speed after 6 months of work rehabilitation. Hogarty et al. (2004, 2006) found that improvements in processing speed and neurocognition from cognitive training in the first six months of their two two-year intervention and mediated subsequent social cognition and social adjustment outcomes.

CONCLUSION

The present study confirms the crucial role of vocational rehabilitation in patients with chronic schizophrenia. The patient all learned the skill of book binding during the 6 months. There was no drop out in the study. Token economy based on the principles of operant conditioning improved the patient's behaviour; patients were more cooperative, adaptive, attitude towards other patients improved, responsible and punctual. Cognitive domains such as attention, concentration, set shifting, cognitive flexibility, psycho motor speed, visual motor coordination, planning also improved. It is generally accepted that work is therapeutic and is important part of life, filling much of a patients time, provides social interaction and support, all patient responded well to the positive reinforcement showing the efficacy of token economy procedures and the success rate of vocational rehabilitation.

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