

# Addition of home-based cognitive retraining to treatment as usual in first episode schizophrenia patients: A randomized controlled study

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## ABSTRACT

**Objective:** We examined the effectiveness of a 2-month-long home-based cognitive retraining program together with treatment as usual (TAU; psychoeducation and drug therapy) on neuropsychological functions, psychopathology, and global functioning in patients with first episode schizophrenia (FES) as well as on psychological health and perception of level of family distress in their caregivers.

**Materials and Methods:** Forty-five FES patients were randomly assigned to either treatment group receiving home-based cognitive retraining along with TAU ( $n=22$ ) or to control group receiving TAU alone ( $n=23$ ). Patients and caregivers received psychoeducation. Patients and one of their caregivers were assessed for the above parameters at baseline, post-assessment (2 months) and at 6-months follow-up assessment.

**Results:** Of the 45 patients recruited, 12 in the treatment group and 11 in the control group completed post-intervention and follow-up assessments. Addition of home-based cognitive retraining along with TAU led to significant improvement in neuropsychological functions of divided attention, concept formation and set-shifting ability, and planning. Effect sizes were large, although the sample size was small.

**Conclusions:** Home-based cognitive retraining program has shown promise. However, further studies examining this program on a larger cohort with rigorous design involving independent raters are suggested.

**Key words:** Cognitive retraining, first-episode schizophrenia, psychoeducation, global functioning, psychopathology

## INTRODUCTION

Schizophrenia is characterized by cognitive deficits present in several cognitive domains in the prodromal, symptomatic, and chronic stages.<sup>[1-4]</sup> Cognitive deficits and negative symptoms impair social functioning, work performance, and community functioning.<sup>[5-10]</sup>

Cognitive retraining has emerged as a treatment modality to reduce cognitive deficits, with the expectation that improvement of cognition would result in clinical improvement as well as improvement of psychosocial functioning.<sup>[11,12]</sup> Meta-analytic studies have shown moderate

to large effect sizes.<sup>[13-15]</sup> Cognitive retraining studies till date have been carried out in chronic schizophrenia patients, with only a handful of studies examining remediation of cognitive deficits in early phase of the illness.<sup>[16-19]</sup>

Although cognitive deficits are known to exist prior to the onset of illness, only four studies with randomized control design have examined the effect of cognitive retraining in the early phase of the illness with mixed results.<sup>[16-19]</sup> Eack *et al.*<sup>[16]</sup> compared cognitive enhancement therapy (CET) with enriched supportive therapy (EST). Wykes *et al.*<sup>[17]</sup> examined the 3-month long cognitive remediation therapy (CRT). Ueland and Rund<sup>[18]</sup> and Delahunty *et al.*<sup>[20]</sup> studied the effect

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How to cite this article: Hegde S, Rao SL, Raguram A, Gangadhar BN. Addition of home-based cognitive retraining to treatment as usual in first episode schizophrenia patients: A randomized controlled study. Indian J Psychiatry 2012;54:15-22.

### Access this article online

**Website:**  
[www.indianjpsychiatry.org](http://www.indianjpsychiatry.org)

**DOI:**  
10.4103/0019-5545.94640

### Quick Response Code



of a 30-hour cognitive remediation program. Only two of the above four studies have found clinically significant change after cognitive retraining.<sup>[16,17]</sup> In both studies, improvement occurred in the targeted cognitive functions and social functioning, with reduction of negative symptoms. The results have shown that instituting cognitive remediation early in the course of the illness benefits the patient.

These programs were carried out in hospital setting by a therapist. Longer durations combined with frequent hospital visits would increase treatment costs and limit wider application. The high cost of treatment combined with the hassle of daily hospital visits makes treatment adherence difficult in cognitive retraining. Hence, there is a need to develop a cognitive retraining program which is easy to implement and inexpensive. A home-based cognitive retraining program may be the answer as it eliminates daily hospital visits, making it user friendly. The reduction in costs due to reduced staff costs in the hospital and the reduction of travel cost to the patient might enable a longer duration of treatment at a lower cost.

The present study was carried out with an aim to develop a cognitive retraining program targeting a range of cognitive functions known to be impaired in schizophrenia. It was also aimed to make this cognitive retraining program home based, with a minimum level of monitoring by a family member. Such a program would reduce the financial and personal burden of visiting the hospital frequently. The intervention program would then be a cost-effective treatment for schizophrenia. The efficacy of the program in first-episode schizophrenia patients was tested by comparing it with routine treatment given in our hospital.

## MATERIALS AND METHODS

### Sample

The sample consisted of 45 patients with an International Classification of Diseases-10 (ICD-10) diagnosis of schizophrenia in the first episode of illness. Based on the clinical history and clinical examination, diagnosis as per the ICD-10 criteria was made by the resident psychiatrist, and concurred by the consultant psychiatrist. Duration of illness was less than 2 years. Patients spoke English or Kannada or Hindi fluently, had adequate visual and hearing ability, and had minimum education up to 5<sup>th</sup> grade. Patients with a diagnosis of mental retardation, presence of neurosurgical conditions or neurological condition other than schizophrenia, and those who had undergone electroconvulsive therapy in the past 6 months were excluded. One member who was identified as patient's primary caregiver (parent/spouse/sibling/relative) living with the patient for at least the past 6 months and actively involved in taking care of the patient, not having any current psychiatric illness, was included in the study. The research study was approved by the National Institute's ethics

committee and written informed consent was obtained from the patients as well as the caregivers.

### Assessment of patients

Psychopathology profile of patients was obtained using the Positive And Negative Syndrome Scale (PANSS).<sup>[21]</sup> Disability in overall functioning was assessed using the WHO Disability Assessment Schedule-II (WHODAS-II).<sup>[22]</sup> The neuropsychological tests administered were: Digit Vigilance test,<sup>[23]</sup> Color Trails test,<sup>[24]</sup> Triads test<sup>[25]</sup> to assess attention; finger tapping test<sup>[26]</sup> to assess motor speed; Digit Symbol Substitution<sup>[27]</sup> to assess mental speed; Token test<sup>[28]</sup> to assess verbal comprehension; Animal Names test,<sup>[23]</sup> verbal N-back – Task,<sup>[29]</sup> Stroop test,<sup>[25]</sup> Tower of London,<sup>[30]</sup> Wisconsin card sorting test (WCST)<sup>[31]</sup> to assess various executive functions; Rey's auditory verbal learning test (RAVLT)<sup>[32]</sup> to assess verbal learning and memory and Rey Osterrieth complex figure test (CFT)<sup>[33]</sup> to assess visuo-constructive ability and visual memory.

The scores on the neuropsychological tests were compared with norms appropriate to that of the subject's gender, age, and education. Indian norms for the tests in the neuropsychological battery have been developed based on literacy [illiterates, school educated (1st to 10th std), and college educated (11<sup>th</sup> std and above)], age [young adults (16–30 years), middle-aged adults (31–50 years), and older adults (51–65 years)], and sex (males and females). In each of the above intersections of gender × age × education, 30 normal volunteers were tested. Percentile scores were calculated for each test variable in each of the above intersection groups.<sup>[25]</sup> The 15th percentile score (1 SD below the mean) was taken as the cut-off score.<sup>[34]</sup> Whether the patient had paid fulltime or part-time employment or was not at all employed was also noted.

### Assessment of caregivers

The caregivers were assessed based on general General Health Questionnaire (GHQ-28)<sup>[35]</sup> and the Scale for Assessment of Family Distress (AFD).<sup>[36]</sup> GHQ-28 was used to measure the overall psychological health. The Likert scoring method of 0–1–2–3 with a threshold score of 39/40 was used. The AFD is a self-rating scale for assessment of family distress experienced due to an ill member in the family. The scale has a list of 25 different behaviors and option for allowing caregivers to mention any other behavior causing distress. The severity of distress was captured on a 5-point rating scale. The symptoms were grouped under four categories, viz., activity related, self-care related, aggression related, and depression related. The severity of distress was measured using a 5-point rating scale (0=no distress, 1=minimal distress, 2=moderate distress, 3=marked distress, and 4=intense distress).

### Design

The study used a randomized controlled design. Patients

who fulfilled the inclusion and exclusion criteria were randomly allocated to either the treatment group or the control group. The experimental group received a 2-month home-based cognitive retraining program along with treatment as usual, which included drug treatment and psychoeducation. Control group received treatment as usual (drug treatment and psychoeducation). Both groups received three sessions of psychoeducation. The tests / tools were administered to patients and caregivers at baseline (prior to the intervention), post-assessment (after the intervention), and at 6-month follow-up (4 months after completion of the intervention). The first author SH assigned the patients to the two groups using random allocation method. She carried out the assessment of patients and caregivers as well as conducted the psychoeducation sessions.

## Intervention

### Home-based cognitive retraining program

The tasks in the retraining program were presented in a graded fashion. The task difficulty increased gradually as the retraining program progressed. The program included tasks that could be performed by the patient in the home setting, with a minimum level of monitoring by the caregiver. A brief description of the cognitive retraining tasks and domains targeted has been given in Table 1.

The program consisted of two sets which were printed in a booklet form. Tasks for week 1-4 were given in Set 1, while those for week 5-8 were given in Set 2. The patient was given Set 1 after the baseline assessment. Set 2 was given to the patient 1 month later. In each set, the tasks for each week were marked separately using a color marker. The number of tasks to be carried out each day was also designated. The patient and caregiver were instructed on how to perform each task. The task was also demonstrated. The patient was instructed to note the time taken to complete each task. Based on the instructions given, the caregiver was asked to monitor the session without being over involved or punitive.

After the initiation of the home-based cognitive retraining program, the researcher met the patient and caregiver twice, once after completion of 4th week and the second time after completion of 8th week. The researcher reviewed the performance on the retraining program during this meeting. Completion of two-thirds of the tasks given for each week was considered as adequate compliance. The caregiver and patient were asked to telephone the researcher to clarify doubts at any time during the retraining.

### Psychoeducation session

As per the American Psychiatric Association (APA) guidelines for treating schizophrenia patients,<sup>[37]</sup> psychoeducation was provided to all patients along with medication. Three psychoeducation sessions at pre-assessment, 1-month follow-up, and post-assessment were held with the caregivers and the patients in both groups. Each session

lasted 45 minutes to 1 hour. The psychoeducation session gave information regarding the nature of diagnostic symptoms, prevalence, average age of onset, course of the illness, nature of positive and negative symptoms, types of cognitive deficits, and importance of positive feedback and emotional support by the caregivers.

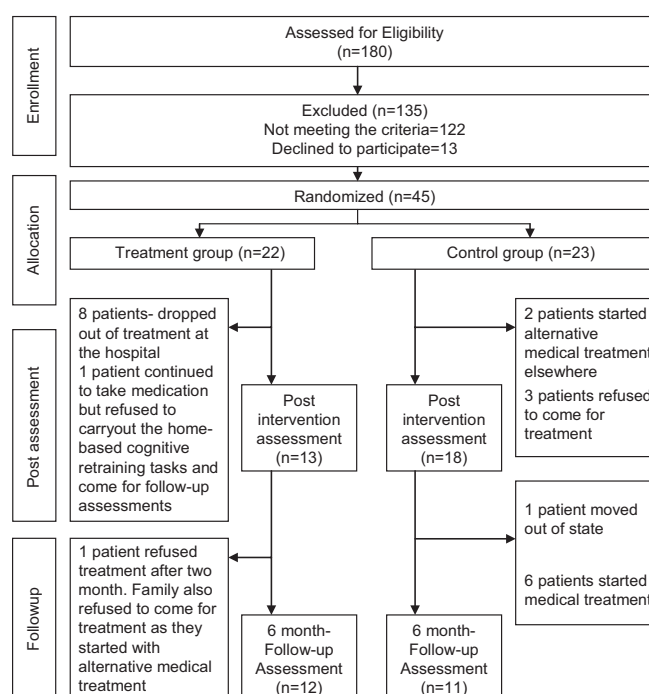
### Adherence to treatment (home-based cognitive retraining program)

Of the 22 patients who were recruited into the treatment group, 13 completed the 2-month home-based cognitive retraining program [Figure 1]. All patients completed minimum of two-thirds of the retraining program. The least adhered to and completed task was the short essay writing task and the proverb illustration task, which only 7 of 13 patients completed. The performance on each of the cognitive retraining tasks was measured quantitatively, such as time taken to complete the task or errors committed or total correct responses. Two tasks – the short essay writing task and illustration of proverb task – were assessed qualitatively.

## RESULTS

### Characteristics of the patient group

A total of 45 patients and their caregivers were enrolled in the study. Twenty-two patients were randomized to the treatment group and 23 to the control group. Figure 1 depicts the sample allocation details and dropout of patients in treatment and control groups at post-intervention and follow-up assessments. The socio-demographic and clinical details of the patients who completed the study are depicted in Table 2. Analysis of data was carried out



**Figure 1:** Flowchart of patients recruited in the present study

on the patients who completed the follow-up assessment ( $n=12$  in treatment group,  $n=11$  in control group). The two groups did not differ in the clinical variables of duration of illness, distribution of subtypes of schizophrenia, and symptomatology or level of overall functioning. However, the treatment group had better education and socioeconomic status than the control group.

In the treatment group, 58.3% of patients were in gainful

employment and the rest were unemployed. In the control group, all were in gainful employment.

Variables which were skewed logarithmic transformations were performed to normalize data prior to analyses. The two groups were compared on all variables at baseline using *t*-test (Bonferroni correction employed). At baseline, the two groups did not differ in the neuropsychological test scores, level of general psychopathology, and global functioning.

**Table 1: A brief description of the home-based cognitive retraining program**

Cognitive domain	Retraining task (week it was administered)	Task description
Attention	Number connection (week 1–3)	Serially connecting numbers placed randomly on an A4 sheet. The task was given in three levels of difficulty increase in task difficulty was achieved by increasing total numbers to be connected
Mental speed	Letter symbol substitution (week 1–2)	Similar to the Digit Symbol Substitution task. <sup>[27]</sup> The task involved substituting designated symbols corresponding to letters of the English alphabet. Task was given in two levels of difficulty. Increase in task difficulty was achieved by increasing the number of target symbols and number of letters to which corresponding symbols had to be inserted
	Grain sorting (week 1–4)	The task involved sorting of mixed grains into piles of similar grains. The task was given at three difficulty levels. This task has been used in cognitive remediation program for head-injured subjects. <sup>[43]</sup> Task difficulty was achieved by increasing the types of grains. Decreasing the size of grains increased the task difficulty
Working memory	Rearrangement of jumbled words (week 3–4)	The task was to rearrange the letters to make a meaningful word. Words chosen for this task were simple nouns and words, having an average of four to six letters. The task was given in one difficulty level
Non-verbal fluency	Design fluency (week 3–4)	Similar to the Design Fluency test <sup>[44]</sup> and design fluency task of the cognitive retraining for head-injured patients. <sup>[45]</sup> The task consisted of generating novel and multiple abstract designs within a stipulated time. The tasks were given at two levels of difficulty. In level one, four symbols were provided to aid the task performance. Newer designs could be formed using the given four symbols. In level two, no such aid was provided
Verbal fluency	Word generation (week 4)	Similar to Controlled Oral Association test. <sup>[46]</sup> The task consisted of generating as many words as possible starting with a selected letter within a stipulated time. The task was given in one difficulty level
Response inhibition	Design coloring (week 1–6)	Similar to the Coloring task from the cognitive retraining of head-injured patients. <sup>[47]</sup> The task involved coloring a design using color pencils. The evenness in pressure on the strokes and strokes not crossing the borderlines of the design were emphasized. The task was given at five levels of difficulty. Task difficulty was increased by increased the complexity of the design to be colored
Planning	Maze completion task (week 6–8)	Beginning with the start point, patient had to trace the way out in the maze without tracing into a blind alley. The task was given at three levels of difficulty. Increased task difficulty was achieved by the complexity of maze with increase in blind alleys and the route to reach the end point
Planning	Short essay writing (week 8)	The task involved writing a short essay on a given topic. The topics were related to activities that pertained to patient's interest and daily activities. The task was given at one level of difficulty
Sustained attention, set-shifting ability	Letter cancellation task (week 4–7)	The task involved cancellation of two target letters in a given array of randomly arranged letters printed on an A4 size sheet. Task similar to this has been used in children with head injury. <sup>[48]</sup> The task was given at four levels of difficulty. Increase in task difficulty was achieved by increasing the number of rows and columns of letter and decrease in font size
	Number cancellation (week 8)	Arabic numerals from the array of numerals 0–9 were randomly arranged in a number of rows on an A4 size sheet. The task involved cancellation of designated target numbers. The task was given at one difficulty level
Visuo-constructive ability	Dot-based design construction (week 5)	The task was similar to the task Organization of Dots in the Instrumental Enrichment program. <sup>[49]</sup> The task involved construction of three target designs, geometrical designs, using the dots placed in each of the 10 boxes. The task was given at a single level of difficulty
Visuo-spatial reasoning	Tracing embedded figures (week 6)	The task involved tracing an embedded simple figure hidden within a complex figure. Six simple figures were placed in two rows with three figures per row. Beneath each figure, a complex design was placed. This complex design contained the simple figure. The task was given in at one level of difficulty
Abstraction	Proverb illustration (week 7)	The task involved illustration of a given proverb. Patient was asked to write the meaning of the proverb with an example. The task was given in one level of difficulty
Visual memory	Memory for designs (week 7–8)	The task involved drawing a given design from memory. Each abstract design contained five to eight components, which was exposed for 10 seconds. Patient was asked to observe the design carefully and try to memorize the various components. In each session, there were 10 designs. The task was given at one level of difficulty



### Characteristics of the caregivers' group

In the treatment group, 66.7% were males with an average age of  $39.00 \pm 10.41$  years and a mean education of  $12.75 \pm 3.93$  years. The relation was parent 33.3%, spouse 16.7%, siblings 41.7%, and others 8.3%. In the control group, 45.5% were males with an average age  $36.18 \pm 13.45$  years and a mean education of  $9.00 \pm 2.44$  years. The relation was parent 45.5%, spouse 45.5%, and sibling 9.1%.

### Effect of intervention on patients – Cognitive functions, psychopathology and global functioning

The treatment and control groups were compared across the three time points with the generalized linear mixed model (GLMM) repeated measures analysis of covariance (ANCOVA) (with education as a covariate) using the statistical package for the social sciences version 15.0. The dependent measures in patients were scores on the neuropsychological tests, severity of psychopathology, and level of global functioning. The dependent measures in the caregivers were measures of general health and level of family distress. Effect sizes (Cohen's *d*) were calculated to measure the extent of improvement due to treatment.

The significant treatment effect showed that treatment as usual improved neuropsychological variables mental speed (finger tapping test), sustained attention (Digit Vigilance test), focused attention (Color Trails 1 and 2), divided attention (Triads test), category fluency (Animal Names test),

verbal working memory (verbal N-back 1 and 2), response inhibition (Stroop test), planning (Tower of London test), concept formation and set-shifting ability (WCST), verbal learning and memory (AVLT), visual learning and memory (CFT), global functioning (WHODAS-II), and decrease in positive syndrome, negative syndrome, and general psychopathology - PANSS from the baseline assessment to post-assessment as well as from post-assessment to follow-up assessments [Table 3].

In addition, the significant group effects showed that cognitive retraining improved cognition and reduced negative symptoms. As shown in the group effect (two groups compared across three time points) and by the *post hoc* comparisons, the treatment group had significantly lesser negative symptoms and better performance in the neuropsychological tests assessing motor speed (finger tapping right hand), verbal working memory (verbal N-back 1 and N-back 2), concept formation and set-shifting ability (WCST), verbal learning (AVLT), and visuo-constructive ability (CFT-copy) [Table 4].

The group  $\times$  treatment effect showed that treatment group had significant improvement in the neuropsychological domains of divided attention (Triads test), planning (Tower of London test), concept formation and set-shifting ability (WCST) in the experimental group. The effect sizes between the treatment and control groups were large in the post-assessment and follow-up assessment, with one

**Table 2: Socio-demographic and clinical details of the patient group**

Variable	Treatment group (n=12)	Control group (n=11)	t/ $\chi^2$	P
Age in years, mean (SD)	27.75 (5.25)	31.00 (7.93)	1.16	0.25
Years of education, mean (SD)	14.33 (3.84)	11.18 (1.60)	2.52	<b>0.02</b>
Gender			1.01	0.31
Male (%)	9 (75)	10 (90.9)		
Female (%)	3 (25)	1 (9.1)		
Marital status			2.10	0.14
Never married (%)	9 (75)	5 (45.5)		
Married (%)	3 (25)	6 (54.5)		
Socioeconomic status			5.79	<b>0.05</b>
LSSES % (< 3000 per month)	1 (8.3)	6 (54.5)		
MSES % (< 3000–8000 per month)	9 (75)	4 (36.4)		
HSES % (> 8000 per month)	2 (16.7)	1 (9.1)		
Occupation			6.11	0.10
Student (%)	1 (8.3)	1 (9.1)		
Homemaker (%)	1 (8.3)	1 (9.1)		
Employed (%)	5 (41.7)	9 (81.8)		
Unemployed (%)	5 (41.7)	0		
Psychopathology (PANSS)				
Positive, mean (SD)	20.00 (7.68)	16.63 (5.08)	1.22	0.23
Negative, mean (SD)	25.75 (6.94)	27.81 (3.45)	0.89	0.38
General psychopathology, mean (SD)	44.08 (6.86)	45.18 (14.09)	0.24	0.81
Global functioning (WHODAS-II)				
Total score, mean (SD)	52.71 (8.11)	53.95 (7.81)	0.37	0.71
Medication dosage – Risperidone equivalent (mg/day)				
At pre-intervention, mean (SD)	4.33 (1.07)	3.81 (0.98)	1.19	0.24
At post-assessment, mean (SD)	4.00 (0.73)	3.63 (0.67)	1.22	0.23
At follow-up assessment, mean (SD)	3.83 (0.93)	3.27 (0.90)	1.45	0.16

LSSES – Low socioeconomic status; MSES – Middle socioeconomic status; HSES – High socioeconomic status; Significant *P* values are highlighted in bold fonts

**Table 3: Treatment effect – Shows the variables on which treatment effect was significant**

Cognitive domains and variable	F	Sig.
Attention		
Digit symbol substitution test (time taken)	(2,52) 7.38	0.002
Digit vigilance test (time taken)	(2,51) 6.90	0.002
Color trails 1 (time taken)	(2,52) 6.25	0.004
Color trails 2 (time taken)	(2,55) 9.61	<0.001
Triads test (error score)	(2,50) 13.45	<0.001
Executive functions		
Verbal N-back 1, hits	(2, 43) 6.93	0.002
Verbal N-back 1, errors	(2, 52) 10.16	<0.001
Verbal N-back 2, hits	(2,55) 3.51	0.03
Verbal N-back 2, errors	(2,67) 5.69	0.005
Stroop effect score	(2,48) 4.18	0.02
Tower of London test (total no. of problems solved with minimum moves)	(2,61) 10.63	<0.001
Category fluency (total score)	(2,55) 3.25	0.04
WCST - no. trials administered	(2,63) 15.00	<0.001
WCST Error score	(2,60) 16.50	<0.001
WCST perseverative response score	(2,61) 4.04	0.02
WCST perseverative error score	(2,62) 4.52	0.01
WCST non perseverative error score	(2,57) 4.40	0.01
WCST conceptual level responses	(2,59) 12.71	<0.001
WCST no. of categories completed	(2,53) 15.62	<0.001
Verbal comprehension		
Tokens test (total no. of correct responses)	(2,52) 5.57	0.006
Verbal learning and memory		
AVLT trial 1	(2,51) 6.31	0.004
AVLT trial 3	(2,59) 8.38	0.001
AVLT trial 4	(2,55) 5.42	0.007
AVLT trial 5	(2,61) 6.31	0.003
AVLT total score	(2,56) 8.56	0.001
AVLT immediate recall score	(2,62) 7.38	0.001
AVLT delayed recall score	(2, 56) 10.72	<0.001
Visual learning and memory		
CFT immediate recall score	(2,56) 16.21	<0.001
CFT delayed recall score	(2,53) 5.57	<0.001
Psychopathology		
PANSS positive syndrome	(2,48) 73.30	<0.001
PANSS negative syndrome	(2,60) 100.71	<0.001
PANSS general psychopathology	(2,50) 74.16	<0.001
Global functioning		
WHODAS total score	(2,57) 258.96	<0.001

WCST – Wisconsin card sorting test; AVLT – Auditory verbal learning test; PANSS – Positive and negative syndrome scale; CFT – Complex figure test; WHODAS – WHO disability assessment schedule

exception. This was the total number of problems solved with minimum moves in the Tower of London test, where the effect size was small [Table 5]. The interaction effect on global functioning or psychopathology was not significant.

### Effect of intervention on caregivers – Psychological health, family distress

The group effect and the interaction effects were nonsignificant on the measures of psychological health and perception of level of family distress between the caregivers of the two groups.

## DISCUSSION

This is the first study which has developed and examined

the effect of home-based retraining program in first-episode schizophrenia patients. The significant interaction effect has shown that addition of cognitive retraining to treatment as usual led to improvement in executive functions such as divided attention, planning, concept formation and set-shifting ability, following treatment. The large effect sizes indicate the improvement to be substantial. Further, the improvement sustained for 6 months even though treatment had ceased. The improved cognition in the treatment group cannot be attributed to practice on the neuropsychological tests as the control group also underwent the pre-, post- and follow-up assessments. Supplementing the interaction effect is the group effect which has shown better motor speed, verbal working memory, concept formation and set-shifting ability, verbal learning, and visuo-constructive ability. Since the two groups were comparable at baseline on the above functions, the significant group effect may be attributed to the effect of intervention.

Several factors could have played a role in the improvement observed. First, cognitive functions were targeted employing the bottom-up method. Basic cognitive functions such as attention and mental speed were targeted in the initial phase of the retraining program, followed by higher-order cognitive functions such as planning and set-shifting ability later in the program. Secondly, tasks were arranged in increasing level of task difficulty, thereby not taxing the patient unduly, and facilitated learning. Thirdly, improvement in executive functions may have had a cascading effect on improving other functions such as motor speed, verbal learning, and visuo-constructive ability. Fourthly, the very fact that patient was made to feel less “patient-like” by placing the responsibility of carrying out cognitive retraining by himself/herself with very minimal involvement by the caregiver may have enhanced motivation. Also, the gradual increase in difficulty would have helped to sustain motivation to perform the tasks. Medalia and Choi<sup>[12]</sup> have highlighted the fact that motivation mediates adherence and improvement in cognitive functions via cognitive remediation programs.

The present study also found a reduction in negative symptoms as seen by the group effect similar to the findings by Wykes *et al.*<sup>[17]</sup> The observed decrease in negative symptoms may be attributed to the improvement in executive functions. Negative symptoms are associated with poor executive functions.<sup>[38,39]</sup> The present results found improvement in seven functions of which four (divided attention, concept formation and cognitive flexibility, verbal working memory, planning) were executive functions. Goal-directed behavior is improved by executive functions.<sup>[40]</sup> It may be hypothesized that improved executive functions improved goal directedness which was reflected as reduced negative symptoms.

The additional improvements noted above, attributable to cognitive retraining, have not included further improvements

**Table 4: Group effect – Showing the variables on which the two groups were significantly different**

Variable	Group	Mean	Std. error	F	Sig.
Motor speed					
Finger tapping right	Treatment	46.0	1.5	(1,46) 5.96	0.019
	Control	40.6	1.4		
Executive functions					
Verbal N-back 1, errors	Treatment	.7	0.2	(1,23) 5.12	0.03
	Control	1.4	0.2		
Verbal N-back 2, hits	Treatment	5.7	0.2	(1,35) 4.60	0.03
	Control	4.8	0.2		
Verbal N-back 2, errors	Treatment	4.2	0.3	(1,35) 5.76	0.02
	Control	5.2	0.2		
WCST – no. trials administered	Treatment	110.6	2.8	(1,51) 6.06	0.017
	Control	120.6	2.6		
WCST – Conceptual level responses	Treatment	53.3	3.2	(1,42) 6.65	0.013
	Control	41.2	3.0		
WCST – Categories completed	Treatment	4.2	0.3	(1,43) 4.84	0.03
	Control	3.1	0.3		
Verbal learning and memory					
AVLT trial 5	Treatment	11.4	0.4	(1,45) 4.68	0.03
	Control	10.1	0.4		
Visual learning and memory					
CFT-copy	Treatment	33.9	0.7	(1,41) 5.50	0.02
	Control	31.2	0.7		
Psychopathology					
PANSS negative syndrome	Treatment	17.34	0.82	(1,39) 6.03	0.019
	Control	20.14	0.78		

WCST – Wisconsin card sorting test; AVLT – Auditory verbal learning test; CFT – Complex figure test; PANSS – Positive negative syndrome scale

**Table 5: Interaction effect (group × treatment)**

Variable	F	Cohen's d Post-intervention	Cohen's d Follow-up assessment
Divided attention			
Triads test	(2,50) 5.16**	0.88**	0.96**
Executive functions (planning and concept formation and set shifting)			
Tower of London test (TNMM)	(2,61) 3.21*	0.21*	0.89**
WCST no. of trials administered	(2, 64) 4.56**	1.45**	0.97**
WCST errors	(2,60) 7.85**	1.44**	1.34**
WCST perseverative responses	(2, 61) 4.17*	1.08**	0.99**
WCST perseverative errors	(2, 62) 3.78*	1.16**	1.03**
WCST conceptual level responses	(2,59) 4.17*	1.32**	1.46**
WCST no. categories completed	92,54) 7.43**	1.47**	1.58**

Shows the variables on which the group and treatment effect was significant and effect sizes (Cohen's d) at post-intervention assessment and at follow-up assessment between treatment and control groups; TNMM – Total no. of problems solved with minimum moves; WCST – Wisconsin card sorting test; \*\*&lt;0.01; \*&lt;0.05; \*\*Large effect size; \*Small effect size

of global outcome. Addition of cognitive retraining may have resulted in changes in global functioning which may not have been picked up during the interview and assessment carried out using the WHODAS.

Improvement in measures of psychological health and family distress did not differ significantly between the groups following intervention. The caregivers in the present sample had probably not reached the level of distress that is generally observed in chronic illness group. When a patient and caregiver visit hospital in the initial phase of the illness, the family has little knowledge of the causes, symptoms, and management of the illness. Tolerance will be high toward changes in patient's behavior and symptoms. It is known from previous studies that improved caregivers'

knowledge about the illness leads to decrease in relapse and rehospitalization.<sup>[41,42]</sup> The increased knowledge gained through psychoeducation may have improved the psychological health as well as resulted in decrease in perceived level of distress.

The present study had significant dropout of patients from recruitment period to follow-up assessment period. Patients who dropped out of treatment either started medical treatment elsewhere or refused to come for treatment. Refusal of treatment could reflect family members' difficulty in accepting the diagnosis of the illness or avoidance of stigma attached with a diagnosis of psychiatric illness or stigma associated with visiting a tertiary mental hospital where the study was carried out.

This study had several limitations such as small sample size, significant dropout, and absence of independent rater who was blind to the allocation of patients to the two groups. Using a quantitative method to measure even subtle changes in global functioning and occupational functioning could have added to the strength of the study. In spite of these limitations, the 2-month-long home-based cognitive retraining program has improved cognitive functions and decreased negative symptoms. Increasing the duration of the home-based retraining program and combining it with other social skills' training program may improve cognition, clinical functioning, and overall functioning further.

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Source of Support: Nil, Conflict of Interest: None declared