Cognitive Rehabilitation in Schizophrenia

March 15, 2011 | <u>Schizophrenia</u> [1], <u>Schizoaffective</u> [2], <u>Schizophrenia Psychotic Features</u> [3], <u>Addiction</u> [4]By <u>Irene M. Hurford, MD</u> [5], <u>Solomon Kalkstein, PhD</u> [6], and <u>Matthew O. Hurford, MD</u> [7]

Schizophrenia is associated with severe cognitive deficits that interfere significantly with daily functioning and quality of life. **Source:**



Patients with schizophrenia have profound and disabling cognitive

deficits. More so than positive or negative symptoms, cognitive deficits impair daily functioning and contribute most to chronic disability and unemployment.^{1,2}

Unlike the psychotic symptoms, these deficits do not improve during periods of remission and change only minimally with antipsychotic medications. 3,4

Given the enormous impact that cognitive dysfunction has on the daily lives of persons with schizophrenia, researchers and clinicians have been working for more than 2 decades on strategies to improve cognition in this population.

In this article, we summarize general concepts in cognitive rehabilitation in schizophrenia. Our goal is to provide a basic framework for clinicians who are planning to initiate a cognitive remediation (CR) program for their patients.

Cognitive deficits in schizophrenia

In persons with schizophrenia, cognitive impairments are detectable as early as age 6 or 7 years, or the earliest age at which children receive any formal psychological tests.⁵⁻⁸ The underlying pathology is almost certainly present in some form at birth. By first grade, children in whom schizophrenia develops are already performing at nearly a full grade equivalent below their peers.⁵ There appears to be a period of further cognitive decline (or rather, failure to make age-appropriate gains) between the ages of 12 and 17—several years before the first psychotic episode.^{5,6,9} After the first episode, and the patient has stabilized clinically, the cognitive deficits remain fairly stable.¹⁰⁻¹² At that point, scores of global cognition range from between 1 and 2 standard deviations below those of healthy cohorts.^{13,14}



Table 1 Definition of cognitive domains affected in schizophrenia		
Cognitive measure	Oxfordian	
Bokag namaty	Temperary unline starage of information and mental manipulation of information	
Abertion (sushained locused attention or eightron)	Ability to maintain a consident behavioral response Terosphoal a continuous at repetitive activity	
Speed of processing	More basic cognitive processes insching speed of performance, subether perceptual or mater	
Noted learning and memory	The ability to acquire and rebain werbal information, such an werbal instructions	
Weampelial learning and memory	The ability to acquire and relate visual information, such as figures and maps	

While all domains of cognition are affected in schizophrenia,

there are selective areas of increased impairment—particularly verbal and visuospatial memory, attention, executive function, and speed of processing (**Table 1**).¹⁵⁻²⁰ Verbal memory impairments are the most robust and the most profound.^{10,14-16,18} Impairments in cognition are not related to illness state and are present and stable even during periods of positive-symptom remission. In fact, positive symptoms and cognitive deficits are only negligibly correlated.²¹ However, negative and disorganization symptoms show modest correlations with cognition.^{21,22}

Functional consequences of cognitive deficits

Relative to the positive, negative, and disorganization symptom domains, cognition is the strongest predictor of functional outcome.^{1,2} Cognitive deficits in schizophrenia have been shown to interfere with various aspects of daily functioning, including employment, independent living, and quality of life.²³⁻²⁶ In 2 literature reviews, Green and colleagues^{1,2} demonstrated that 4 specific neurocognitive domains were significantly associated with functional outcomes: executive functioning, immediate verbal memory, secondary verbal memory, and vigilance. Community activity (eg, working, going to school) was predicted by measures of executive functioning and secondary verbal memory. Social problem-solving skills were associated with levels of secondary verbal memory, vigilance and, to a lesser extent, executive functioning. Psychosocial skill acquisition was most frequently linked with immediate and secondary verbal memory.²

Definition of cognitive rehabilitation

There are 2 main techniques in cognitive rehabilitation: remediation and compensatory approaches. CR is designed to stimulate new learning, or relearning, of cognitive tasks, and thus, to improve domains of deficit. Compensatory approaches seek to make improvements in the patient's functioning by avoiding areas of impairment and recruiting other intact cognitive domains or by creating a supportive external environment.²⁷



Compensatory techniques

Compensatory approaches aim not only to improve cognitive functioning by reducing errors in the learning process but also to minimize impediments to activities of daily living and to create a supportive home environment. Errorless learning (EL) and cognitive adaptation training (CAT) are 2 compensatory approaches that have yielded successful outcomes when they are used in patients with schizophrenia.

EL is guided by the theory that certain neurologically impaired groups, including persons with schizophrenia, have difficulty in learning when their mistakes are corrected in an effort to guide future behavior.²⁸ EL aims to eliminate any errors when new tasks are being learned. This approach reduces each new task to be learned into small component parts that are then overlearned through "imitative learning and repetitive practice of perfect task execution." By doing so, EL relies on implicit memory processes; this provides an advantage for patients whose explicit memory abilities are compromised. Implicit learning refers to learning that occurs unconsciously and that is often procedural (eg, riding a bike). In contrast, explicit learning is conscious and is often more information-based.

Compensatory strategies have also been applied to the schizophrenia patient's home environment. CAT introduces environmental adaptations that are suited specifically to the executive impairments common among schizophrenia patients. Its aim is to reduce the cognitive burdens, functional requirements, and overall stress of everyday living in each patient's personal space.²⁹

During home visits, CAT therapists check for safety hazards and ensure that necessary supplies are available. The therapists may also assist in modifying and reorganizing the home in a manner customized to the individual patient's needs. For example, in the bedroom, clothing drawers are labeled and colored bins are used for the sorting of dirty and clean clothes. In the bathroom, grooming supplies are moved to be more easily accessible and pill containers are introduced to organize medications. In addition, patients can be trained to use watches or other devices with alarms to cue themselves to take medications and complete other tasks.³⁰

Cognitive remediation techniques

While early CR programs used paper and pencil tasks, most are now computerized. Some remediation programs use a mix of general educational software, but many train participants with specialized computer software designed to improve cognition (<u>Table 2</u>).³¹ Often the software is adapted from computer exercises for remediating age-related cognitive decline, brain injuries, or learning disabilities in children.^{32,33} Currently, most programs use a form of drill and practice training, which refers to the use of hundreds of trials of the same exercise to "push" intrinsic learning systems that are hypothesized to be intact in schizophrenia.³⁴ Because of its repetitive nature, drill and practice runs the risk of boring participants. This is mitigated by the use of computer game-like motivations and rewards, such as colors, noises, increasing scores, and encouraging words.

Memodation programs and resources		
Research program	Program, Web alls, or adhears package	Additional elements
Systee electronic Surget**	A series of 700 Suphrist adhere High Supplices Records Observation	Social applies remediates is and graps
Incorplic algorithm (height)	Redfiel wears of PEI Sightful advers High frees represidents only can PEI pass that	Realized which liable
Tomay Sale to Manuar	CogNut onlinese Mischerer Cognet.com	Realised what Makes, sugarised wephysical
hat loans**	Paul Science Mijs Ferency politicience.com	
Nonpophological Introduced Approach In Adriad Matter	Espetia Novalatia Ior Pantalajiai Banton Tengatrikato	Bridging groups

A few CR programs focus primarily on a strategy-coaching approach, in which the therapist and a small group of patients discuss methods and strategies to improve cognition and to use cognitive-training exercises. Strategy-coaching methods do not usually focus on the repetition of hundreds of trials per exercise; rather, they place more emphasis on developing and maintaining motivation in the participants.³¹

The Neuropsychological Educational Approach to Rehabilitation (NEAR) method uses a strategy-coaching approach.³¹ This approach also includes small-group sessions (bridging groups) that occur after the computerized CR portion of the training. Participants discuss strategies that they learned while practicing the tasks as well as how the skills they are learning in the sessions can be generalized to real-world activities, such as independent living and employment. In a 2007 meta-analysis, McGurk and colleagues³⁵ found that the combination of drill and practice training and strategy coaching was more effective than either system alone.

Most CR programs aim to improve the cognitive domains usually associated with deficits in schizophrenia—for instance verbal and visual working memory, executive function, attention, and processing speed. This is a top-down approach in which the target of training is a higher-order cognitive process.





Fisher and colleagues³⁶ adopted a computerized remediation program called Posit Science. This program focuses on early auditory and visual sensory processes, such as tone and phoneme discrimination, as well as higher-order cognitive processes, such as verbal memory. Vinogradov believes that focusing on early sensory processing in schizophrenia is important because previous research findings indicate that there are early sensory processing deficits in schizophrenia.³⁷ By improving these early sensory processes, there will be a bottom-up improvement in higher-order cognitive domains.

To date, there has been no head-to-head comparison of bottom-up and top-down approaches. While almost all CR programs use at least some repetitive practice of cogni-tive exercises to target domains of deficit, many also include other unique components beyond drill and practice.

Cognitive enhancement therapy (CET), developed by Hogarty and colleagues,³⁸ includes small-group sessions that emphasize social cognition. CET improves neurocognition and shows trends toward improving social cognition. In a randomized trial using CET, improvements in neurocognition and some aspects of social cognition independently predicted improvements in functional outcome.

Neurocognitive enhancement therapy (NET), a program that was developed by Bell and colleagues,³⁹ pairs a drill and practice style computerized CR with vocational rehabilitation programs. His team has demonstrated that the combination of the two improves work outcomes significantly compared with vocational rehabilitation alone.

McGurk and colleagues⁴⁰ also pair CR with a supported employment program. Their Thinking Skills for Work program has 4 components:

• Cognitive assessment and job loss analysis that identifies the role of cognitive deficits in past job performance and motivates patient participation in the cognitive training program

· Computer-based cognitive training sessions

• Discussion of cognitive gains made following the completion of training and future-oriented planning with the patient and employment specialist

• Ongoing follow-up between the employment specialist and the patient to develop additional compensatory strategies to manage cognitive deficits interfering with job performance

Effectiveness of cognitive rehabilitation

Compensatory strategies. Kern and colleagues²⁸ explored the effectiveness of EL in community settings. The results of their work show improvement in the learning of simple entry-level job tasks, such as index card filing and toilet tank assembly. Another community-based study used EL to train participants with schizophrenia or schizoaffective disorder in entry-level tasks at a thrift-type clothing store and found significantly better work quality when compared with participants trained using conventional methods.⁴¹

Randomized studies have demonstrated that CAT results in greater adaptive function, better quality of life, and fewer positive symptoms than other forms of psychosocial treatment.⁴² CAT has also been associated with a reduced incidence of re-hospitalization and with improved levels of



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motivation and community functioning.⁴³ While EL and CAT use different compensatory approaches, both appear to be beneficial in the treatment of cognitive deficits in schizophrenia.

Cognitive remediation. CR has been demonstrated to improve overall (global) cognition as well as specific domains, including attention, executive function, working memory, verbal learning and memory, processing speed, and affect recognition.^{38-40,44-47} The effect sizes for improvements in cognitive domains generally fall into the small to moderate range (about 0.3 to 0.6).^{35,45} Effect sizes for improvements in global cognition tend to be in the moderate range as well.^{35,45} (Of note, moderate effect sizes are generally considered meaningful in the social sciences, but the improvements in cognition after CR merely attenuate the degree of deficit, which still remains large compared with that in control subjects.) These improvements in cognition often persist after CR has ended.³⁵ In their study, Hogarty and colleagues⁴⁸ tested participants 12 months after the completion of CET and reported that improvements in processing speed, cognitive style, social cognition, and social adjustment persisted.



Furthermore, results from a randomized controlled trial using MRI data indicate that 2 years of CET therapy resulted in decreased gray matter loss in several areas of the cortex and increased gray matter in the amygdala in participants with early-onset schizophrenia.⁴⁹ However, not all studies have found that CR improved cognitive performance. Dickinson and colleagues⁵⁰ conducted a randomized controlled trial and reported that while CR improved cognitive domains and global cognition when tested on the same exercises included in the remediation program, neither global cognition nor any cognitive domain improved when tested with a standardized neurocognitive battery. This study illustrates the potential danger of training to the test or of testing subjects using cognitive batteries too similar to the tasks practiced in the CR program.

Effect on functional outcome and quality of life

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The ultimate goal of all the programs discussed is the successful transfer of gains made in CR to improvements in functional outcome and quality of life. Multiple studies have shown improvements in measures of functional capacity or functional outcome after CR. In addition, improvements in global cognition as a result of CR have been demonstrated to mediate improvements in measures of functional outcome.⁵¹ However, it appears that for CR to best translate into improvements in functional outcome, it should be paired with some other psychosocial rehabilitation program, such as vocational rehabilitation or social skills training. Findings from the meta-analysis by McGurk and colleagues³⁵ showed that CR in conjunction with other psychiatric rehabilitation programs improved psychosocial functioning measures more than just CR alone.

CR has been shown to enhance the effectiveness of vocational rehabilitation and to lead to higher employment rates, more hours or weeks worked, and higher wages, both in noncompetitive and competitive employment.^{40,44,50-54} Not all studies have found improvements in functional outcome with CR, however.^{50,55}

Conclusion

Schizophrenia is associated with severe cognitive deficits that interfere significantly with daily functioning and quality of life. Compensatory programs can recruit intact cognitive skills or marshal environmental supports to improve functioning. CR lessens cognitive deficits, and when paired with other rehabilitation programs, can lead to lasting improvements in cognition and daily functioning.

Keep in mind that persons with schizophrenia often have poor insight into their cognitive deficits, which potentially limits the appeal of time-consuming remediation programs.⁵⁶ Clinicians may need to frame the goals of CR in very concrete terms to encourage participation in the program.

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