

## **Cognitive rehabilitation for people living with schizophrenia – the newest interventions**

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### **Summary**

The article reviews the latest interventions in cognitive rehabilitation for patients with schizophrenia. Studies referring to cognitive rehabilitation for people with schizophrenia from the last three years, found in the PubMed database, are presented. The authors categorised cognitive rehabilitation trainings in terms of targeted cognitive spheres – neurocognitive training, social cognition training, emotion perception training and combined training – and present current trends within these approaches. Cognitive function improvements after cognitive remediation are specific to the rehabilitation target and there are no clear differences between training types in the way they influence other cognitive domains or symptoms. There is a need to heighten transfer of gained/enhanced cognitive skills to functional ones. Therefore new methods of cognitive remediation are explored. The future direction in cognitive rehabilitation is to enhance benefits by combining various forms of cognitive remediation and by emphasizing patient specificity in planning and conducting cognitive interventions.

**Key words:** schizophrenia, cognitive remediation

### **Introduction**

Cognitive remediation constitutes the behavioural training based treatment of cognitive deficits in schizophrenia, which are one of the most disabling symptoms of the illness. Cognitive remediation methods vary in content, setting, and targets, but all of them are aimed at improving core cognitive impairments in schizophrenia in permanent way and with the effects on functioning. The essence of each cognitive remediation is to engage patients in learning processes which improve cognition relevant to the intervention's specific goals. There are multiple cognitive remediation

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programmes which could be divided in terms of targets and methods. In the matter of targets, there are interventions focused on higher or basic neurocognitive functions, social cognition, emotional cognition, or interventions which have multiple targets. In the case of methods, remediation programmes can be laboratory-based (practice regarding abstract ability) or more ecological-oriented (practice refers to real-life situation). This article presents the division of cognitive remediation therapy programmes in terms of targeted cognitive spheres: neurocognitive training, social cognition training, emotion perception training (as a specific form of social cognition training), and combined training (combined interventions targeted different cognitive spheres). Within these approaches we described the newest interventions and their efficacy. Finally, we presented recent trends in cognitive remediation in schizophrenia which take into consideration individual cognitive difficulties, and emphasize that the remediation programme needs to be adequate to cognitive problems experienced by patient in his natural conditions.

### **Neurocognitive Trainings**

The aim of neurocognitive remediation is to improve cognitive impairments in schizophrenia such as: memory and attention deficits, decreases in processing speed, limitations in reasoning and problem solving, planning and other functions. There are two main approaches among the different neurocognitive training: the first one consists of interventions known as Cognitive Remediation Therapy (CRT), which are sets of cognitive exercises; the second one is called Compensatory Cognitive Training (CCT), and consists of compensatory interventions designed to enhance cognitive functioning.

Cognitive Remediation Therapy is typically a computer-based training, providing exercises, with progressively increasing difficulty level, that are assumed to enhance or restore impaired functions. It is believed that this kind of intervention can cause changes not only at behavioural, but also at neural level [1]. There are several programmes offering a range of cognitive exercises, which compete with one another in the provision of engaging and attractive software to motivate and challenge users. Meta-analysis of computer-assisted cognitive remediation programmes' efficacy in patients with schizophrenia shows small effect size for general cognition improvement [2]. Other meta-analytic studies, which take into account not only computerized programmes, but also different remediation methods, report durable effects of cognitive remediation on cognition and functioning, with small to moderate effect sizes [3, 4]. The main difference between CRT and CCT is that the latter is focused on learning strategies, which are consciously used by the participants, while the first is based on implicit learning. Owing to CRT the participants acquire skills and abilities indirectly through repetitive practice of cognitive exercises. The aim of CCT is to improve the patient's functioning through bypassing or compensating for impaired areas of cognition. Rather than "providing a remedy", it enables a person to circumvent, to some extent, defective cognitive processes. This goal is accomplished

by teaching participants special and easy to use strategies to overcome difficulties in day-to-day functioning. Studies report its durable post-treatment and follow-up effects on memory, attention, functional capacity, negative symptoms and quality of life [5], as well as its effectiveness for older, chronically hospitalised or low functioning schizophrenia patients [6, 7].

Neurocognitive remediation approach described above includes multiple cognitive domains which reflects heterogeneity of cognitive impairments in patients with schizophrenia. Cognitive deficits of attention, working memory, visual and verbal learning, reasoning and problem solving, and social competence are well established in schizophrenia [8, 9]. However, studies also provide an evidence of the existence of dysfunctions at more fundamental level of cognitive processing, for which the broad range of neurocognitive trainings seems to be insufficient [10, 11]. Therefore, specific interventions are to be developed. Surti et al. investigated whether improvements in visual processing obtained in schizophrenia patients after specific cognitive exercises generalise to more complex cognitive functions like visual and auditory learning, and information manipulation. The generalisation was observed only in visual learning [12]. Existence of advanced computerized technology enable to engineer very specific training programmes, for example computer-assisted training of visual motion processing [13]. There are also cognitive interventions which exercise higher, but selected cognitive processes such as autobiographical memory [14], as well as new generation computerized cognitive training based on neuroscience findings [15, 16].

### **Social Cognition Trainings**

Cognitive remediation is also used as a psychosocial intervention for schizophrenia patients in whom social cognition is a treatment target. Social cognition is the ability to correctly process information carried by socially relevant stimuli and to use it to generate adequate response in social situations [17]. Social cognition is the name for a number of processes, such as the perception of emotions, decision making in social situations, assigning people to specific mental states. Social cognition trainings are a broad and continuously expanding group of trainings that are hypothesised to have more direct influence than neurocognitive trainings on real-world functioning. One of such intervention is Mental-State Reasoning Training for Social Cognitive Impairment (SoCog-MSRT). Studies on this programme reports that it can significantly improve schizophrenia patients' theory of mind abilities (interpretation of human behaviour based on assigning specific mental states), inferring of mental states based on eyes, and social situations understanding, but it is limited in its outcomes for patients with poor working memory and a premorbid Intelligence Quotient [18]. Other interventions such as Meta Cognitive Training (MCT) are focused on thinking processes that have an influence on social situation understanding [19, 20]. Although MCT has been known since 2005, recently its additional positive outcomes in various areas of functioning have been seen. MCT

patients showed improvement in delusion distress, memory and social quality of life [21]. Study on MCT carried by Naughton et al. advances interesting idea that psychological interventions could have hidden advantages. In the case of MCT this could be restoration of understanding and reasoning as part of decision making capacity [22]. Another interesting example is the theory of mind and emotion processing training [23] – although its efficacy was seen only in theory of mind abilities and not in emotional processing, the study emphasises the role of ecological techniques in cognitive remediation. Other new social cognition trainings are Social Cognition and Interaction Training (SCIT), which is focused on emotion perception, attribution styles and theory of mind [24], and Social Cognitive Skills Training (SCST), which consists of emotional processing, social perception, attribution bias, and metalizing exercises [25]. Both trainings are based on the assumption that participants should begin from the most basic social skills exercises and gradually move towards more complex ones. SCST uses skill building strategies known in psychiatric rehabilitation. Complex social processes are broken down into their component skills and systematically practiced to become a patient's routine. Then the acquired skills are integrated and trained through the role playing and watching special videos. SCIT training has three stages. The first stage is to practice basic emotions perception and learning about the relationship between emotions, thinking, and behaviour (exercises with the therapist and commercially available computer-based programmes). The second stage is to learn to recognize situations (e.g. learning about pitfalls of jumping to conclusions, attributions styles, social facts and guesses), which uses various types of exercises, games, strategies and supporting materials. The last step is to put into practice the skills and knowledge acquired by the patients during the training and to reinforce these skills and knowledge by analyzing, step by step, patients' real troubling interpersonal situation. Involving patients' families in the process of social cognition remediation is a new idea [26], although cooperation with patients' families is well known and legitimised in psychoeducation.

### **Emotion Perception Trainings**

Emotional perception trainings are more specific forms of social cognition trainings. They deal with the impairment of emotion perception not only through mental operations, but also through neurocognitive perceptual functions. Social cognition is the ability to process and to apply social information, which seems to be extremely difficult without accurate recognition of other peoples' emotions. Cognitive emotional trainings are mostly computerised and focused on the identification of specific emotions or the differentiating between intensities of emotional expressions. One of the novel interventions in the field of cognitive emotion remediation is emotion recognition training using Ekman's Micro-Expression Training Tool (METT). The training makes patients more sensitive to important facial features, by giving information about important features for each particular facial expression of emotion. The aim is to improve recognition of emotions by making changes to

the visual scanning of facial expressions. Studies report that this kind of training can improve recognition of emotions and change the way schizophrenia patients perceive the features of facial expressions of emotion [27]. Another computer-based training programme is Training of Affect Recognition (TAR), which focuses on impairments in facial affect recognition [28]. The training programme combines repeated practice with compensation methods by giving patients alternative strategies for information processing (for example, verbalisation, self-instruction, and the generation of associations using situational clues and context information). Schizophrenia patients participating in six-week TAR programmes not only benefit in terms of greater emotion recognition than the usual treatment group, but also in terms of quality of life and clinical symptoms [29].

### **Combined Trainings**

The purpose of cognitive remediation in schizophrenia is to improve patients' independent functioning via improvements in neurocognition and/or social cognition. There are evidences that when cognitive remediation is combined with psychiatric rehabilitation the effect on functional outcomes is more favourable [3, 4, 30, 31]. For example cognitive remediation can be combined with functional skills training [32]. New forms of enhancing remediation's benefits such as: combining different remediation approaches (cognitive remediation with emotion perception remediation [33], neurocognitive remediation with social cognitive training [34-36], problem solving training and cognitive flexibility [37]) or combining cognitive remediation with medical treatment (cognitive-enhancing drugs [38, 39], brain transcranial direct stimulation [40]) are currently being considered. Cognitive remediation can also be successfully combined with other adjunctive interventions. It is well known that, in combination with supported employment, this remediation produces satisfactory results [41]. Recently, researchers have begun considering new fields of interventions that could be reinforced by cognitive remediation. Kidd et al. investigated the effectiveness of cognitive remediation combined with a supported educational programme for young individuals with psychosis and found this intervention to enhance cognitive measures and improve students' educational outcomes [42, 43].

### **Current trends in cognitive rehabilitation**

As mentioned above, some studies report significant effects on trained functions after cognitive remediation, but no generalisation to independent cognitive task performance, with respect to social abilities and functional outcome is reported [44]. In case of computer-assisted trainings it could be caused by their laboratory bias. Limited alternative to this problem could be a compensatory cognitive training which is much more based on practising functioning in real life situations. A new and promising approach to cognitive remediation is an individualised and everyday life approach. The idea is that the great heterogeneity of the observed cognitive

deficits in schizophrenia demands a detailed and individualised neuropsychological investigation. One example of computer-based individualised neurocognitive remediation is Recos [45] or NIT which is used in conjunction with SSIT (Social Skills Individualized Training) [46]. Before a patient starts treatment, an evaluation is carried out to identify which modules fit the patient's deficits best and thus should be trained. Another example of going beyond laboratory exercises is RehaCop, the Spanish non-computerised neurocognitive training [47]. Every group of exercises that hits a specific neurocognitive deficit in schizophrenia is divided into five levels of difficulty. The most difficult and final level is to use trained neurocognitive functions in real-life tasks. Interventions that go further and offer individual and everyday life approaches necessitate not only a cognitive, but also a clear-sighted functional assessment and formulation of concrete objectives for patients' everyday difficulties. Levaux et al. evaluated this kind of cognitive intervention. Based on an analysis of the patient's cognitive profile, day-to-day functioning, and the processes involved in disturbed activities, they constructed individual strategies for patients (for example, working memory exercises to improve the ability to follow conversations). The results showed that an improvement in patients' cognitive and everyday functioning was sustained at the three-year follow-up [48]. Another intervention that targets patients' daily functioning problems is a modified version of Goal Management Training (GMT), which is designed for schizophrenia patients with executive function deficits reflected in daily-life functioning. The aim is to improve planning and the implementation of plans to achieve goals. Studies reveal its efficacy in terms of planning improvements in laboratory tasks, trained and untrained real-life situations, and self-esteem [49].

### **Conclusions**

Schizophrenia is a group of heterogeneous disorders [50] also characterised by a broad range of cognitive impairments and is difficult to set up single successful intervention for people affected by impairments in many aspects of their life. Findings from the literature suggest that cognitive functions improvements are specific to the rehabilitation target. However, the main objective of cognitive remediation is to improve patients functioning. Therefore new techniques that enhance transfer of cognitive skills to functional skills are explored. One of these new techniques is combining various forms of cognitive remediation or combining cognitive remediation with other treatment methods, as well as personalization of cognitive remediation methods to meet patients' specific cognitive and functional needs.

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