

# The implementation of cognitive remediation interventions in Campania

D. Palumbo\*, S. Patriarca\*,  
A. Mucci, M. De Angelis,  
I. Di Crosta, G. Piegari,  
S. Galderisi

*Department of Psychiatry, University of  
Campania "Luigi Vanvitelli", Naples, Italy*

*\* These authors contributed equally  
to this manuscript*

## Summary

*Cognitive impairment is considered a core aspect of schizophrenia and an important therapeutic target for its negative impact on real-life functioning of affected people. Psychotropic drugs commonly used in the treatment of schizophrenia do not improve and might even worsen cognitive dysfunctions. In contrast, cognitive remediation (CR) was found to improve cognitive deficits and real-life functioning of subjects with schizophrenia. The present paper aims to provide a brief review of the theoretical basis of different CR programs and to illustrate the implementation of two such programs in Campania. In particular, the Social Skills And Neurocognitive Individualized Training (SSANIT) and the Computerized Interactive Remediation of Cognition - Training for Schizophrenia (CIRCuiTS) will be illustrated. SSANIT is an integrated program, including individualized computerized CR and social skills trainings.*

*CIRCuiTS is a stand-alone computerized CR program targeting the development of metacognitive skills. Factors informing the choice of a specific CR program for individual subjects are also illustrated.*

## Key words

Cognitive remediation • Social Skills And Neurocognitive Individualized Training (SSANIT) • Computerized Interactive Remediation of Cognition Training for Schizophrenia (CIRCuiTS)

## Introduction

Cognitive impairment has been considered a nuclear aspect of schizophrenia since the earliest descriptions of the syndrome. However, for several decades the evaluation and treatment of cognitive dysfunctions have not been the focus of research in this area. In a few research centers, the evaluation of cognitive functions was mainly focused to the characterization of pathophysiological mechanisms of the syndrome<sup>1,2</sup>. Over the past decade, a broad consensus has been achieved on the definition of cognitive dysfunction as an important target of clinical research<sup>3</sup>.

The Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) project identified seven distinct cognitive domains compromised in schizophrenia patients: processing speed, attention/concentration, working memory, spatial memory, verbal memory, problem solving and social cognition<sup>4</sup>. These cognitive deficits are present, in attenuated form, even before a full blown psychotic episode and in non-affected first-degree relatives, suggesting that cognitive deficits can be biological markers of the disorder<sup>5,6</sup>. In addition, cognitive deficits predict functional capacity (i.e., the ability to perform tasks of everyday life in a controlled environment, e.g. write a check to pay a bill or reschedule an appointment with a doctor), considered a mediator of the impact of cognitive deficits on real-life functioning<sup>5,6</sup>. In the light of these data, the impairment of cognitive functions is considered a central aspect of treatment and clinical management of the disorder. The available pharmacological treatments do not have a proven efficacy on cognitive deficits in patients with schizophrenia<sup>9</sup>. Therefore, several cognitive re-

## Correspondence

Armida Mucci  
Department of Psychiatry,  
University of Campania "Luigi Vanvitelli",  
L.go Madonna delle Grazie 1, 80138 Naples,  
Italy • Tel. +39 081 5665153  
• E-mail: armida.mucci@gmail.com

mediation techniques (“Cognitive Remediation”, CR) were developed.

The purpose of this article is to provide a brief review of the principles on which the different interventions of CR are based and to illustrate the programs implemented in Campania by our Department.

### **Cognitive remediation in schizophrenia: rationale and techniques**

CR is defined a “behavioral training-based intervention that aims to improve cognitive processes (attention, memory, executive function, social cognition or metacognition) with the goal of durability and generalisation” (cognitive remediation experts Workshop [CREW], Florence, April 2010). It is widely recognized that CR techniques, unlike pharmacological treatments, represent an effective method for the improvement of cognitive functions in schizophrenia<sup>10</sup>. The hypothesis that the training of cognitive abilities might improve these functions is corroborated by the most recent neuroscientific evidence of brain plasticity during the whole life span in relation to the quantity and quality of the received stimuli<sup>11</sup> and by data showing neurobiological changes, i.e., an increase in gray matter, following CR<sup>11</sup>. Two different theoretical CR models have been elaborated: the compensatory and the restorative ones. The “compensatory” model tries to eliminate or overcome specific cognitive deficits, using the residual cognitive abilities of the subject and/or environmental resources. The “restorative” model is based on the neuroscience findings, such as neuronal plasticity, and aims to correct specific deficits by trying to repair the underlying impaired functions<sup>12</sup>. The restorative method uses two different strategies called “bottom-up” and “top-down”. The bottom-up approach begins with the training of basic neurocognitive skills, such as attention, and then remediate more complex functions, such as problem solving. In contrast, top-down approaches starts from more complex skills, targeting the development of metacognitive skills, such as self-control and strategies for learning and for the application of cognitive skills. The latter approach might facilitate the transfer of the improved cognitive skills to real-life situations<sup>13</sup>.

CR uses several learning strategies, such as errorless learning, scaffolding, massed practice, positive reinforcement and information processing strategies<sup>13</sup>. In recent years, numerous cognitive computerized and non-computerized techniques have been implemented, designed as training programs for individual or group settings<sup>14</sup>.

CR has been offered to subjects with schizophrenia as stand-alone programs (targeted interventions), or within an integrated rehabilitation program, in association with a psychosocial rehabilitation intervention (e.g., social skills training or supported work).

### **Targeted and integrated interventions**

Targeted CR interventions hypothesize that training the

basic cognitive deficits leads to an improvement of more complex functions, such as functional capacity and real-world functioning. Integrated interventions (CR + psychosocial interventions) aim to provide a context in which to actively practice the new skills acquired with CR.

To date, some meta-analyses confirm the efficacy of CR techniques<sup>10 15-17</sup>. Specifically, these interventions improve the cognitive performance of the patients (both on trained and untrained cognitive tasks) and have a moderate effect on the real-life functioning<sup>10 15-16</sup>. Although both targeted and integrated training programs demonstrated effectiveness in improving cognitive functioning, generalization to the real-life functioning is greater with integrated programs. Targeted interventions, however, present some advantages: 1) impose a limited number of sessions; 2) do not require multiple skills of the therapists; 3) do not require the availability of funds to implement complex psychosocial interventions.

In order to select the most appropriate CR program, it is of utmost importance to consider the clinical needs of the individual patient. A person with impairment only in some cognitive domains, which has a limited impact on real-life functioning, could be the ideal candidate for targeted intervention. Conversely, a subjects with pervasive cognitive deficits and severe impairment of real-life functioning might benefit more from an integrated intervention.

An important task of future research in the field is to clarify whether targeted, top-down interventions, including a specific metacognitive training might improve real-life functioning, overcoming the need to integrate CR with psychosocial interventions.

### **Implementation of CR interventions in Campania**

Starting from the theoretical assumptions and findings reviewed above, the Department of Psychiatry of the University of Campania “Luigi Vanvitelli” has implemented two different rehabilitative interventions: an integrated intervention, the Social Skills And Neurocognitive Individualized Training (SSANIT), and a targeted “top-down” intervention, including a metacognitive training.

#### **Implementation of an integrated rehabilitative intervention: the Social Skills And Neurocognitive Individualized Training (SSANIT)**

The Social Skills And Neurocognitive Individualized Training (SSANIT) was developed by our research group, integrating and modifying two already available interventions, the Social Skills Training and a computerized CR training developed for neurological patients. Particular attention was devoted to the individualization of both interventions, and to the development of strategies to make the skills learned applicable in real life contexts to favor generalization<sup>18</sup>. The psychosocial intervention of SSANIT (Social

Skills Individualized Training, SSIT) consists in a rehabilitative training for interpersonal skills. The SSIT includes different phases: (1) establishing a rationale for learning the skill; (2) discussing the component steps of the skill; (3) modeling the skill in a role play and reviewing the role play with the patients; (4) engaging a patient in a role play; (5) providing positive feedback; (6) providing corrective feedback; (7) engaging the patient in a second role play of the same situation; (8) providing additional feedback and (9) assigning homework<sup>19</sup>. The focus of this part of the SSANIT is to improve people's social competence for areas which are important to function effectively in real life contexts. The learned skills can make the individual able to deal with his/her social network. A better social network would allow the subject to have more opportunities to request help during stressful life events. Furthermore, a greater sense of social autonomy would have a positive effect on the subject's self-esteem. The psychosocial intervention lasts a total of 6 months, with weekly group sessions, of 2 hours each.

The neurocognitive component (Neurocognitive Individualized Training, NIT) of the SSANIT is based on a computerized CR program, RehaCom, developed by HASOMED GmbH (Inc., Ltd) in Magdeburg, Germany<sup>20</sup>. The subject works with RehaCom on a personal computer with a special keyboard with simple, large and light keys. RehaCom is a very flexible software that gives to the therapist the possibility to individualize the intervention. In fact, the therapist can choose different exercises for the training of different cognitive functions, and can set the level of difficulty for each starting session and each domain. Thus, motivation is improved and frustration is avoided. All the training results are automatically saved in RehaCom and a new session starts where the last one ended; therefore, it is possible to check the course of therapy at any time, adjusting the parameters when necessary. For the implementation of the NIT the following RehaCom modules were used: "Attention and concentration", "Verbal memory", "Memory for faces", "Logical thinking", "Shopping" and "Day planning". Two one-hour weekly sessions are provided for a six-month total duration.

The implementation of these interventions involved the working groups of the coordinating center and the Day Care Centers of Campania Mental Health Departments (Avellino 1, Benevento 1, Puglianello and Bucciano), and was divided into the phases illustrated below. During the first phase, personnel for the management of the interventions was identified and trained. For each Day Care Center the *équipe* included two nurses, a psychologist, and a social worker or psychiatric rehabilitation technician. The 3-month training involved attending held 10 2-hour lessons on the theoretical and practical aspects of the integrated intervention, held by a psychiatrist with specific expertise in CR and SST. In the second phase, psychiatrists

and residents in psychiatry in the University Department were trained for psychopathological, cognitive, and real-life functioning assessments. The University Department personnel was only involved in the assessments and not in treatment.

In the third phase, 60 patients with a diagnosis of schizophrenia or schizoaffective disorder were assessed at baseline and then randomized to the SSANIT program or to structured leisure activities (SLA). The fourth phase of the study consisted in the post intervention assessment of psychopathological, cognitive, social and personal functioning.

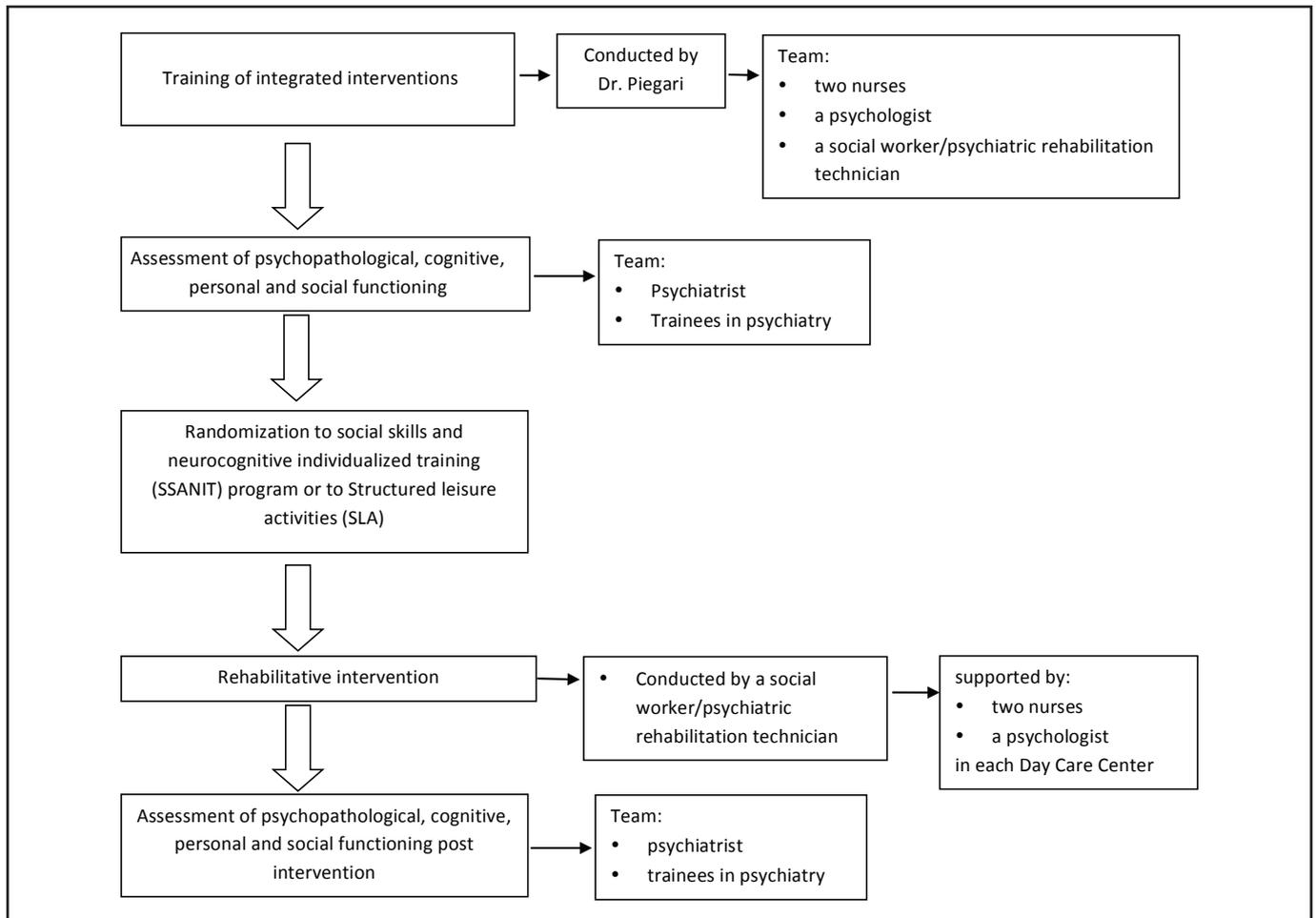
Figure 1 illustrates the procedure followed to implement the SSANIT program.

At the end of the integrated intervention, 11 patients dropped (3 in the SSANIT and 8 in the SLA group). The results showed an improvement in social and personal functioning in SSANIT patients, compared to the control group. No significant group effects were observed on psychopathological variables and cognitive indices. Patients who participated to NIT showed, however, an improvement in the performance at RehaCom, achieving a satisfying performance at the most difficult levels, for all the trained domains, with the exception of the day planning module. In conclusion, the low number of dropouts and the results obtained confirmed the effectiveness of an integrated rehabilitation treatment compared to SLA.

#### Implementation of a targeted cognitive remediation: "Computerized Interactive Remediation of Cognition Training for Schizophrenia" (CIRCuiTS)

In 2010 the research group coordinated by Prof. Wykes developed a new-generation metacognitive computer-based rehabilitation program: The Computerized Interactive Remediation of Cognition - Training for Schizophrenia (CIRCuiTS)<sup>21</sup>. The intervention was designed to improve cognitive skills such as long-term memory, working memory, attention, problem solving, processing speed, comprehension, flexibility and planning, in people with schizophrenia or schizoaffective disorder. Specifically, CIRCuiTS aims to improve metacognitive knowledge (knowledge of one's cognitive skills) and metacognitive regulation (the ability to monitor and control the application of the same skills).

The program is set in a virtual "village" and the activities take place in the relevant buildings. There are 27 tasks, each with 12-15 levels of difficulty, adjusted according to the patient's abilities. Two types of tasks are included: "abstract" and "complex". Abstract activities have a "neutral" content (such as numbers or geometric shapes) and are designed to train specific simple cognitive functions. Abstract, simple tasks are predominant in the first phase of the program, gradually become less frequent and are replaced by more "complex" tasks, which are more "ecological", i.e., similar to everyday life activities (e.g. planning



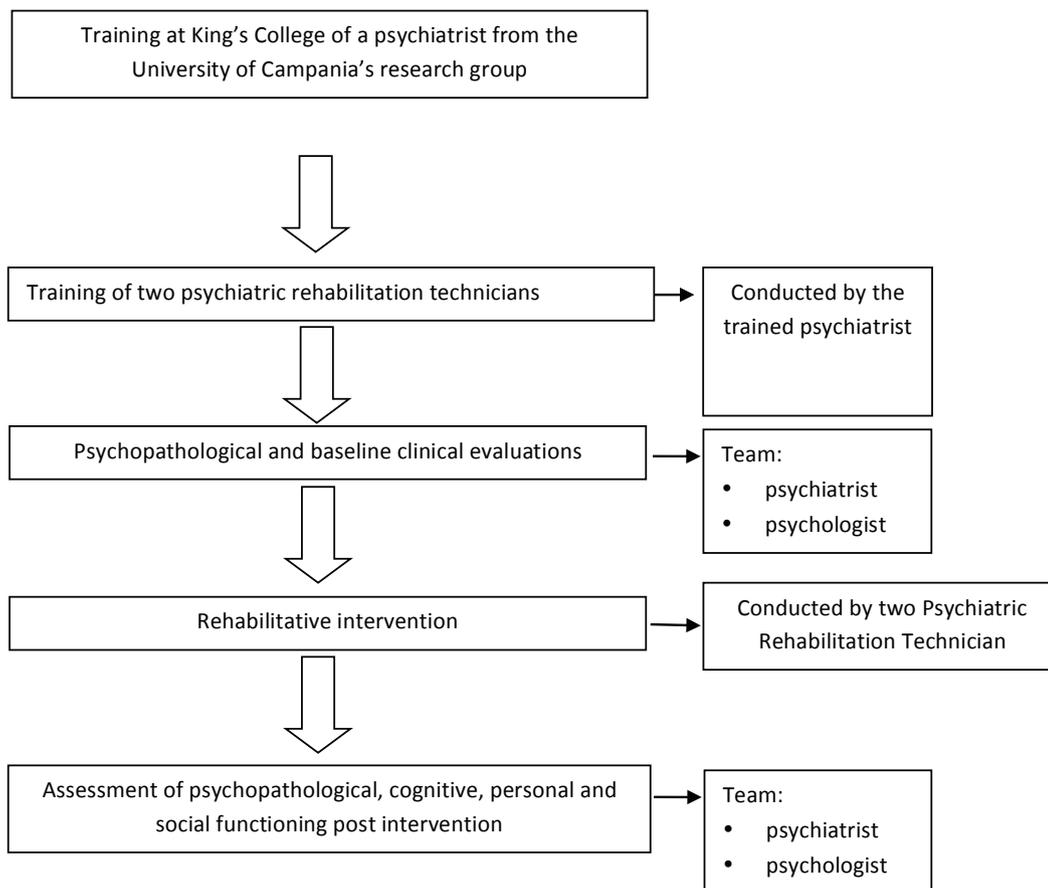
**FIGURE 1.** SSANIT implementation procedure.

a trip, making or recalling a shopping list). The different tasks belong to 5 categories: work, social situations, cooking, shopping and travelling.

Metacognitive regulation is encouraged by asking participants to develop a plan, to estimate the difficulty before beginning a task, than monitor and finally review task performance. After the task, participants review their scores and rate how difficult they found the task and how useful they found the selected strategy. In addition, the program includes specific strategies to encourage the user to draw parallels between activities within the session and everyday life and to apply the new skills learned in real-life situations.

CIRCuiTS includes a maximum of 40 sessions, with a frequency of 3 sessions per week, including, if possible, one patient's home session. Each session lasts about one hour, but duration is adjusted to participants' attentional capacity (being shorter at the beginning and then gradually increasing to match subject's improvement in attention).

The Department of Psychiatry of the University of Campania "Luigi Vanvitelli" has developed a study with the aim to provide data on the feasibility and acceptability of the Italian version of the program in a sample of outpatients of the University Mental Health Department. Before starting the research project, a psychiatrist from the University of Campania followed a two-month training at King's College, taking part in the translation to Italian and adaptation of CIRCuiTS to the Italian cultural context. After this period two psychiatric rehabilitation technicians were trained by the same psychiatrist and conducted the rehabilitation intervention with 4 patients each (8 patients in total). The rehabilitation project was structured in three main phases. During the first phase, a psychiatrist and a psychologist performed the basic cognitive and psychopathological evaluations. During the second phase the intervention was carried out, with two weekly sessions supervised by the psychiatric rehabilitation technicians and a third weekly session conducted autonomously at home by the patient.



**FIGURE 2.** *CIRCuiTS implementation procedure.*

In our center, the home sessions were started after at least 3 weeks of training with the supervision of the therapist. During the last phase, post-treatment cognitive assessments and psychopathological evaluations were carried out.

Figure 2 illustrates the procedure for the implementation of CIRCuiTS program.

No patient dropped from the intervention, confirming that the program has a high acceptability and feasibility. Post-intervention evaluation showed a significant improvement in cognitive indices and real-life functioning. The results of our study are still preliminary, but other studies on CIRCuiTS have already demonstrated the effectiveness of the program<sup>22,23</sup>.

## Conclusions

Our experience confirms that the implementation of targeted or integrated CR interventions is feasible both at University Departments and in Day Care Centers of Mental Health Departments. After a first and more complex phase consisting in the implementation of the intervention (in par-

ticular in the identification and training of the personnel), these programs are found to be feasible and acceptable for both patients and involved personnel. The low percentage of dropouts can be a reliable indicator of the quality of the implementation.

The patients benefit from CR interventions: 1) by improving their cognitive skills; 2) by increasing awareness of their cognitive dysfunctions and of the impact on daily life of the same deficits; and 3) learning strategies to cope with their deficits.

The therapeutic team therefore has an additional tool to improve a nuclear aspect of the schizophrenic syndrome, the impairment of cognitive functions, which has a negative impact on real-life functioning and on effective participation to more complex rehabilitation programs, such as supported work.

To implement a successful intervention, the duration and modality of the intervention must be agreed with the patient and adapted to his/her specific needs (for example, reduced motivation for intensive schedule with several weekly sessions).

In our opinion, to individualize the intervention, patient's clinical and logistic problems, for example the lack of social competence, the presence of residual psychotic symptoms, and logistic difficulties (for example, the distance between the residence of the patient and the Department) should be taken into account. For example, an individual CR intervention can be preferred if the subject has difficulties in engaging in group therapy, due to its reduced social competence or social anxiety; moreover, the possibility of home CR sessions, followed via internet by the rehabilitation technician, can open new perspectives for users who have logistic problems.

Assessment is a critical aspect in the process of therapy individualization. Several psychometric batteries and interviews for the assessment of cognitive functioning have been validated for this purpose. Psychometric tests have the advantage of being more precise, but more complex to

administer. These test batteries generally take more than one hour for a complete evaluation. Interviews for cognitive assessment are less precise but easier to administer. Only after an accurate assessment of cognitive functioning is it possible to identify the right intervention for the individual subject. Italian standardization of test batteries and clinical interviews, in subjects with schizophrenia, has opened the road to the systematic assessment of cognitive dysfunctions in clinical settings.

In conclusion, our experience with several CR programs is positive and has permitted a fruitful collaboration between Academic and non-Academic Mental Health Departments.

## Conflict of Interest

None.

## References

- Bach ME, Simpson EH, Kahn L, et al. *Transient and selective overexpression of D2 receptors in the striatum causes persistent deficits in conditional associative learning*. PNAS 2008;105:16027-32.
- Reichenberg A. *The assessment of neuropsychological functioning in schizophrenia*. Dialogues Clin Neurosci 2010;12:383-92.
- Green MF, Kern RS, Braff DL, et al. *Neurocognitive deficits and functional outcome in schizophrenia: are we measuring the "right-stuff"?* Schizophr Bull 2000;26:119-36.
- Nuechterlein KH, Barch DM, Gold JM, et al. *Identification of separable cognitive factors in schizophrenia*. Schizophr Res 2004;72:29-39.
- Lencz T, Smith CW, McLaughlin D, et al. *Generalized and specific neurocognitive deficits in prodromal schizophrenia*. Biol Psychiatry 2006;59:863-71.
- Mucci A, Galderisi S, Green MF, et al. *Familial aggregation of MATRICS consensus cognitive battery scores in a large sample of outpatients with schizophrenia and their unaffected relatives*. Psychol Med 2017;1-10.
- Galderisi S, Rossi A, Rocca P, et al. *The influence of illness-related variables, personal resources and context-related factors on real-life functioning of people with schizophrenia*. World Psychiatry 2014;13:275-87.
- Galderisi S, Rucci P, Kirkpatrick B, et al. *Interplay among psychopathologic variables, personal resources, context-related factors, and real-life functioning in individuals with schizophrenia: a network analysis*. JAMA Psychiatry 2018;75:396-404.
- Davidson M, Galderisi S, Weiser M, et al. *Cognitive effects of antipsychotic drugs in first-episode schizophrenia and schizophreniform disorder: a randomized, open-label clinical trial (EUFEST)*. Am J Psychiatry 2009;166:675-82.
- Wykes T, Huddy V, Cellard C, et al. *A meta-analysis of cognitive remediation for schizophrenia: methodology and effect sizes*. Am J Psychiatr 2011;168:472-85.
- Eack SM, Hogarty GE, Cho RY, et al. *Neuroprotective effects of cognitive enhancement therapy against gray matter loss in early schizophrenia: results from a 2-year randomized controlled trial*. Arch Gen Psychiatr 2010;67:674-82.
- Velligan DI, Diamond PM, Maples NJ, et al. *Comparing the efficacy of interventions that use environmental supports to improve outcomes in patients with schizophrenia*. Schizophr Res 2008;102:312-9.
- Medalia A, Choi J. *Cognitive remediation in schizophrenia*. Neuropsychol Rev 2009;19:353-64.
- Barlati S, Deste G, De Peri L, et al. *Cognitive remediation in schizophrenia: current status and future perspectives*. Schizophr Res Treatment 2013;2013:156084.
- Kurtz MM, Mueser KT. *A meta-analysis of controlled research on social skills training for schizophrenia*. J Consult Clin Psychol 2008;76:491-504.
- Pilling S, Bebbington P, Kuipers E, et al. *Psychological treatments in schizophrenia: II. Meta-analyses of randomized controlled trials of social skills training and cognitive remediation*. Psychol Med 2002;32:783-91.
- McGurk SR, Twamley EW, Sitzer DI, et al. *A meta-analysis of cognitive remediation in schizophrenia*. Am J Psychiatry 2007;164:1791-802.
- Galderisi S, Piegari G, Mucci A, et al. *Social skills and neurocognitive individualized training in schizophrenia: comparison with structured leisure activities*. Eur Arch Psychiatry Clin Neurosci 2010;260:305-15.
- Bellack AS, Mueser KT, Gingerich S, et al. *Social skills training for schizophrenia. A step by step guide*. New York: Guilford Press 1997.
- Bucci P, Piegari G, Mucci A, et al. *Neurocognitive individualized training versus social skills individualized training: a randomized trial in patients with schizophrenia*. Schizophr Res 2013;150:69-75.
- Reeder C, Wykes T. *Computerised interactive remediation of cognition – Interactive training for schizophrenia (CIRCUITS)*. London: Kings College London 2010.
- Tsapekos D, Taylor R, Cella M. *Feasibility and acceptability of brief cognitive remediation targeting metacognition in acute inpatients with psychosis: a case series*. Neuropsychol Rehab 2017;20:1-15.
- Reeder C, Huddy V, Cella M, et al. *A new generation computerised metacognitive cognitive remediation programme for schizophrenia (CIRCuiTS): a randomised controlled trial*. Psychol Med 2017;4:1-11.