

Cognitive Rehabilitation Programs in Schizophrenia: Current Status and Perspectives

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ABSTRACT

This study reviews the main rehabilitation programs that have been developed to improve cognitive functioning in patients diagnosed with schizophrenia: it describes their main components and procedures and highlights the most relevant outcomes of each one. Additionally, it highlights which lead to subsequent improvement in social functioning. Cognitive rehabilitation is now being commonly included in treatment of schizophrenic patients with cognitive impairment or cognitive deficit. Hence, it is very important to have empirical data on the efficacy of these programs, data which is not always readily available in current literature.

Key words: schizophrenia, cognition, cognitive training, cognitive rehabilitation.

RESUMEN

Este artículo presenta una revisión de los principales programas que se han desarrollado para la mejora del funcionamiento cognitivo en los pacientes con diagnóstico de esquizofrenia. Se describen sus principales componentes, la manera de proceder de cada uno de ellos y sobre que aspectos muestran efectos positivos. Se indica además cuales presentan una mayor relación con la mejora posterior en el funcionamiento social. El entrenamiento cognitivo está pasando a formar parte, de manera habitual, de las de intervenciones que se llevan a cabo con pacientes que presentan déficit o deterioro cognitivo, que son la mayor parte de ellos. Por ello son muy importante los datos empíricos sobre la eficacia de los programas, y no siempre podemos encontrar en la literatura esta información.

Palabras clave: esquizofrenia, cognición, entrenamiento cognitivo, rehabilitación cognitiva.

The first descriptions and studies on cognitive impairment in schizophrenia were created over a hundred years ago. However, most of this period was characterised by misconceptions of the causes of the impairment, as well as a clear lack of understanding of the impact this cognitive dysfunction had on other areas of functioning in a patient. Recent studies have shown that cognitive impairment is a core feature of schizophrenia. For example, Fiovaranti *et al.* (2005), in a review on cognitive deficits in adults with

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schizophrenia, identified 1275 studies made in this field between 1990 and 2003 (see also Heinrichs, 2005 for a comprehensive view of quantitative evidence demonstrating the relevance of cognition as integral part of schizophrenia). Indicating that the deficits are not caused by other collateral aspects of the disorder, but by the illness itself. In fact, for several authors, schizophrenia is largely an essentially neurocognitive disorder (Andreasen, Paradiso & O'Leary, 1998; Green & Nuechterlein, 1999; Elvevag & Goldberg, 2000; Saykin, Shtasel, Gur, Kester, Mozley, & Stafiniak, 1994; Sharma & Harvey, 2000).

Although cognitive deficits had already been described when Kraepelin referred to the decline in mental abilities of his patients, it is only recently that professionals have identified and agreed on the areas affected. The implementation of various initiatives in the United States such as the MATRICS project (Measurement and Treatment Research to Improve Cognition in Schizophrenia) has made it clear that there is still an issue as yet to be resolved: how to improve cognition. In addition to the project's interest in improving cognition by discovering new drugs, professionals active in this field are also looking into how to improve psychological treatment focussed on rehabilitation or cognitive training for schizophrenia. The professionals involved in the MATRICS project have reached consensus on the cognitive areas that are impaired in patients with schizophrenia: Attention/Vigilance; Speed of Processing; Working Memory; Verbal Learning and Memory; Visual Learning and Memory; Reasoning and Problem Solving and Social Cognition (Kern, Green, Nuechterlein & Deng, 2004; Marder & Fenton, 2004).

In the third meeting of the CNTRICS project (Cognitive Neuroscience Treatment Research to Improve Cognition in Schizophrenia), it was agreed (Barch, Braver, Carter, Poldrack & Robbins, 2009) that 6 areas or cognitive domains suffered impairment in schizophrenia: perception, working memory, attention, executive functions, long-term memory and social cognition.

Yet however important it may well be to agree on areas, the cognitive deficits that have been shown to have a consistent relationship with the evolution of the illness in the long-term are the following: memory, executive functions and attention (Muñoz & Tirapu, 2001).

In recent decades interest in these deficits has been growing rapidly, judging, for example, by the number of empirical research papers published in recent years in journals such as *Schizophrenia Bulletin*, *Schizophrenia Research* and *Psychiatry Research*, aiming to discover which cognitive functions are affected, to what extent, with which consequences and how these relate to disease factors (symptoms, social functioning, duration, hospitalization, etc.).

Similarly, in recent decades a whole host of programs has been developed to improve cognitive functioning in schizophrenia, and cognition training has become a regular component of treatment programs for people suffering from schizophrenia (Bellack, Gold, & Buchanan, 1999; Green, Kern, Braff, & Mintz, 2000).

This review aims to describe the principal intervention programs currently available in this field and to present empirical data substantiating their efficiency.

Assuming that a broad and intensive activation of neural processing systems can stimulate neural resources to improve their functioning (neuroplasticity), one could expect that intense activation of the cognitive systems damaged in patients with schizophrenia

would lead to a general and lasting functional improvement. It is from this basic premise that several cognitive training strategies have been developed (Wexler & Bell, 2005). Although researches have used different terminology to describe them, the three most commonly used strategies are “Cognitive Remediation”, “Cognitive Rehabilitation” and “Cognitive Training” (Twamley, Jeste, & Bellack, 2003).

“Remediation” implies a curative treatment. Webster (1986) defines “rehabilitation” as to restore to a state of health or normal activity. In medical terms, “rehabilitation” implies restoring functionality to premorbid levels or to a normal or near normal condition with regard to operation, performance and execution. Brain developmental disorders associated with schizophrenia (Green & Nuechterlein, 1999) mean that it is difficult to easily identify premorbid levels of functioning and normal or near normal functioning may rarely be possible. Thus, “remediation” and “rehabilitation” do not seem to be the most satisfactory terms. The term “habilitation”, meaning educating or training persons with disability to improve their ability to function in society” (Taber, 1997) may be more appropriate. “Training” is defined as “an organised system of education, instruction or discipline” (Stedman, 1995) or “the teaching, drill or discipline by which powers of mind or body are developed” (Webster, 1986). These reflections illustrate that the most fitting term in this field of work could well be cognitive training.

DESCRIPTION OF COGNITIVE TRAINING PROGRAMS

These can be classified into three groups according to the approach that they use to work with patients and are termed in accordance with literature in this area: *training programs to enhance cognition*, compensatory rehabilitation programs and *training programs using computers*.

Training programs to enhance cognition

The aim of these interventions is to improve / increase / train / “restore” cognitive functioning. They focus on the elimination of damage correcting the underlying deficit, with the goal of learning how to do what was done before, more or less in the same way as before. The training is based on laboratory tests designed to improve specific abilities in areas such as perception or memory (Green, 2009). This group includes the following programs.

Cognitive Remediation Therapy (CRT) developed by T. Wykes and his team based on an original program from Delahunty and Morice (1996). Interest in CRT has grown considerably in the last ten years. CRT is a term describing different methods of teaching “thinking” skills, although it has a special significance when it focuses on those cognitive skills affecting people with schizophrenia to a larger extent such as memory and attention (Wykes & Van der Gaag, 2001). It also has a great predictive power relating to a patient’s ability to function in the community.

CRT objectives include: increasing the capacity and efficiency of cognitive functions; teaching global and transferable cognitive schemata to guide response; im-

proving metacognition; increasing motivation; generalization of skills and use of social support (Wykes, Jeste, & Bellack, 2003).

The program consists of three modules: Cognitive Shift Module, Memory Module and Planning Module. Evidence of its efficiency is variable and seems to depend on the specific components of training that are used in each case. In Spain, CRT has been used by Penadés *et al.* (2006) and yielded satisfactory results. Perhaps its greatest application lies in boosting the cognitive and motivational skills needed to properly acquire other skills of greater functional relevance within the rehabilitation process of a schizophrenic patient (De la Higuera & Sagastagoitia, 2006).

The Newcastle Programs is the name given to the contribution from Australia by Morice and Delahunty (1996). These authors began their research into neurocognitive rehabilitation in 1988 and since then have examined three distinct programs.

The first program they used was a modified version of Integrated Psychological Therapy for Schizophrenia (IPT) which they named *The Modified Brenner Program*. This program consists of four modules based on similar IPT ones (to be described later). The program was carried out with four weekly sessions of one hour over two weeks. In parallel, family members followed a psycho educational family intervention program with the support of audiovisual material. Finally, family members together with the patient participated in the IPT module for problem resolution.

The second program was called *The Computer-Assisted Program*. It is a program based on computer exercises that have been specially designed to practise specific neurocognitive functions. It was modified from a program known as Bracy Cognitive Rehabilitation, which was originally designed for patients suffering from brain damage caused by cranial trauma. It basically focuses on attention, perceptive and reasoning functions.

The results obtained in both programs (the modified Brenner and the computer assisted) showed improvements in most WAIS-R tests. However, in executive functions, while there were significant improvements in the Wisconsin Card Sorting Test (WSCT) and in the Tower of London, results continued to suggest deterioration in planning capacity and cognitive flexibility. It was from this that the need arose to create a specific program attempting to improve executive deficits, especially planning skills and cognitive flexibility, which they then called *The frontal/executive program*.

This program is divided into three modules: Cognitive Flexibility Module, Working Memory Module and Planning Module. With this last program the authors found results that were clearly higher than the other two programs as far as frontal-executive functions were concerned.

Cognitive Enhancement Therapy (CET) from Hogarty and Flesher (1991a, 1999b) is a therapeutic procedure combining activities aimed at improving cognitive performance in basic cognitive functions, with interventions that have been developed to boost resources in aspects related to perceptive and cognitive abilities which are critical for the social functioning and general adjustment of people with schizophrenia (Hogarty, Flesher, Ulrich *et al.*, 2004).

CET works with the idea that the primary aim of the intervention is to achieve two basic skills: the first, really more perceptive, which seeks to adequately assess stimuli

and social contexts; the second, more cognitive in nature, refers to the embracing of flexible forms of thinking that allow the presence of multiple alternatives as information sources (divergent thinking), the anticipation of possible consequences of the response and the appreciation of the points of views of others. To do these exercises, alternating use was made of computer software such as the Orientation Remediation Module of Ben-Yishay, Piasetsky and Rattock (1987) used for patients with brain damage and the PSSCogReHab of Bracy with the IPT of Roder *et al.* (2007).

CET is a program directed at people with stable schizophrenia and it aims to improve neurocognitive skills and social cognition. It is a useful technique that goes beyond classical cognitive rehabilitation, tackling areas and disabilities of a wider functional range. Its potential is far-reaching. For example, it is beginning to be tailored to treat patients with their first-episode psychosis (Miller & Mason, 2004), but, as the authors themselves point out, it is not a therapeutic format applicable to all. This is why the intervention is designed for patients with a certain intellectual level (with an IQ above 80) who are psychopathologically stable (De la Higuera & Sagastagoitia, 2006).

Attention Shaping is a program based on approaches to modifying behaviour, including cognition (Menditto, Baldwin, O'Neal, & Beck, 1991; Spaulding, Storms, Goodrich, & Sullivan, 1986). "Shaping" involves selective reinforcement of successive approximations to desired behaviour. Behaviour that is close to what is required is reinforced; inappropriate behaviour is not. At the beginning, training focuses on behaviours that have a high probability of being displayed within the behavioural repertoire of an individual. Once behaviour is established, criteria for reinforcement moves forward encouraging the patient to behave closer to a final model. The new behaviour is then reinforced selectively from then on and these steps are repeated until the desired behaviour is achieved.

Behavioural shaping shares methodological procedures of other training programs such as *errorless learning*. A key difference is that in shaping, training is not designed to specifically prevent errors or potential behaviour that might occur, whereas in errorless learning, the trainer takes active steps to prevent them.

Integrated Psychological Therapy for Schizophrenia (IPT) (Brenner, Roder, Hodel, & Corrigan, 1994; Brenner, Hirsbrunner, & Heimberg, 1996; Roder, Brenner, Kienzle, & Fuentes, 2007) is probably the one cognitive training program that has attracted the largest quantity of empirical studies on its effectiveness (34). It has now been administered to approximately 1507 patients, which has allowed its authors to carry out a meta-analysis (Müller & Roder, 2008; Roder, Müller, Mueser, & Brenner, 2006; Müller & Roder, 2010), that reveal important effects of IPT compared to different control groups. A review of studies published on IPT in Spain can be found in Fuentes, Jimeno, and Cangas (2007). This is a program which goes beyond influencing the non-social cognitive function, to include, within the treatment process, a varied range of psychosocial intervention procedures (i.e. Fuentes, García, Ruiz, Soler, & Roder, 2007) aiming to ultimately achieve ecological evidence of the changes.

It is based on the theoretical premise that there is a close relation between basic cognitive disorders appearing in the illness and functional deficits in the patient (Brenner, 1989; Brenner, Hodel, Roder, & Corrigan, 1992; Brenner, Roder, Hodel, &

Corrigan 1994). The implicit idea is that tackling the former will enable faster and more profound improvement in the latter. It is administered to groups and consists of five sub-programs: cognitive differentiation, social perception, verbal communication, social skills and interpersonal problem solving. These programs are hierarchically organized to achieve optimum effectiveness in the intervention. Basic skills such as concentration, concept forming, abstracting ability, perceptive ability and memory need to be practiced first to allow later development of more complex forms of social behaviour (Brenner, 1986; George & Neufeld, 1985; Hemsley, 1977; Liberman, 1982; Neale, Oltmanns, & Harvey, 1985).

To sum up, the programs to improve cognition have the advantage of being short and intensive, and succeed in achieving improvements in the execution of neuropsychological tests for cognitive functioning. On the other hand, the programs in this group that are not part of integral psychosocial rehabilitation programs, as is the case, for instance, with CRT, do not show effects on global functioning or on psychopathology. When the intervention is integral, as in the case of IPT, there is indeed evidence of positive effects in global terms and not merely at a cognitive level (Roder *et al.*, 2007). In this group of programs, there are aspects that need to be expanded by empirical studies, such as, for example, the assessment of their effectiveness when administered individually rather than to groups of patients, as is the case with most programs.

Compensatory Rehabilitation Programs

The aim of these programs is to overcome or circumvent cognitive deficits to improve broader aspects of functioning by taking advantage of the unimpaired cognitive processes or by making use of help in the surroundings to train behaviour that may be of interest (Green, 2009). Within this group of programs are the following.

Errorless Learning (EL) (Terrace, 1963) is a training program based on the theoretical assumption that making mistakes can negatively affect certain groups with cognitive impairments. Two studies provide evidence that making mistakes during the learning process is especially problematic for persons with schizophrenia (O'Carroll, Russell, Lawrie, & Johnstone, 1999; Pope & Kern, 2006). In EL, the training task is broken down into smaller components to start training first more simple tasks and then later continue with more complex ones. During training, a wide variety of teaching methods are employed and reinforced with instructions to prevent errors occurring. Each component of a skill is over-learned by means of repetition. In EL, two main procedures are used: prevention of errors during the learning phase and automation of perfect task execution.

Kern, Green, Mintz, and Liberman (2003) found that when carrying out occupational tasks cognitive deficits did not appear in those patients that had been trained using EA methods, but they did appear in those trained by conventional means. These results provide evidence that EA could, in effect, compensate deficits in cognitive functioning in people with schizophrenia.

Cognitive Adaptation Training (CAT) (Velligan, Mahurin, Lefton, True, & Flores, 1996) is a compensatory approach using environmental supports and clues such as signs,

check-lists, alarmed drug packaging, and encouraging the organization of belongings and the sequencing of appropriate routines such as administering self-medication and looking after oneself at home. Treatment strategies are based on a comprehensive evaluation of cognitive functioning, behaviour and the surroundings. CAT is centered on the premise that impairment in executive functioning leads to problems in developing appropriate behaviour and may even inhibit it.

On the whole, compensatory programs do seem to prevent errors occurring during the learning process and they try to have tasks carried out perfectly (by breaking them down into smaller steps). However, they do not succeed in achieving premorbid levels of performance. These programs are more aimed at people with significant cognitive impairment that is difficult to restore and this renders them less suitable for people with recent illness who are more intact.

Training programs using computers

The use of computers in training / rehabilitation for cognitive functioning has a relatively long history starting with the development of programs for people with brain damage. These programs improve the execution of tasks that they practice but there is little evidence on their capacity for generalization. Programs mainly focus on attention skills rather than problem-solving ones.

Computer programs do appear to have advantages over methods using pencil and paper, such as, for example, they allow the degree of difficulty to be systematically changed on an individual basis: they give immediate feedback; they allow the use of various reinforcement methods and there is monitoring of the learning process. However there are also drawbacks for patients with schizophrenia because there is little or no social interaction when the program is administered on an individual basis. Rehabilitation programs using computers include the following.

Gradior, is a cognitive training system designed by the INTRAS foundation (Research and Treatment in Mental Health and Services) (Franco, Orihuela, Bueno, & Cid, 2000). The program allows direct interaction between the user and the computer, which manages the evaluation and the neurocognitive training in accordance with some parameters previously established by the therapist. It is aimed at people with brain injuries, dementia, neuropsychiatric disorders with brain damage and mental illness or retardation. It aims to rehabilitate functions such as attention, perception, memory, orientation, calculation and language. So far we have been unable to find any published studies on the effectiveness of this program.

RehaCom (Schuhfried, 1996) is a computer program consisting of different modules with different levels of difficulty and with a sufficient number of options to ensure that a patient is only working with skills that at that moment are relevant to him/her. Additionally it gives specific feedback to detect errors and develop strategies. Some of its modules are: attention and concentration, divided attention, working memory, spatial operations, logical thinking, visuomotor / visuoconstructive abilities, etc.

This program has shown positive results in cognitive functions, in the ability to solve interpersonal problems, in autonomy and symptoms (Cochet *et al.*, 2006).

The Neuropsychological Educational Approach to Rehabilitation (NEAR) was created by Medalia, Revheim and Herlands (2002) and is based on training techniques that are intrinsically motivating, developed within educational psychology and designed to make the tasks enjoyable and compelling. Training includes participating in cognitive exercises with a computer where various cognitive skills are embedded in a contextualized format. This program has demonstrated good results when it has been applied (Choi & Medalia, 2005; Medalia & Lim, 2004; Medalia & Richardson, 2005).

On the whole, it could be said that in spite of the advantages of computer-based cognitive training programs, such as the fact that the level of exercise difficulty can be adjusted to suit patient performance, this method of working has its limitations. The fact that patients administer the treatment themselves, that they work individually, means that they cannot benefit from the “social” component that is afforded by working in groups. It is also important to note that few studies exist demonstrating their effectiveness and the effect on a patient’s overall functioning.

EMPIRICAL EVIDENCE ON THE EFFECTIVENESS OF COGNITIVE TRAINING PROGRAMS

The decision to use a specific cognitive training/rehabilitation program should be based on existing evidence of its effectiveness. The reliable way to ensure this evidence is available is to use meta-analysis. Meta-analysis studies review, integrate, analyze and enable comparison between research results on the effectiveness of various treatments and they generate statistics, such as effect size, which quantifies the “impact” of a certain treatment (Botella & Gambará, 2006; Rosenthal & DiMatteo, 2001).

In recent years it has been easy to find reviews focused on “cognitive training in schizophrenia” and, as can be seen in table 1 below, the findings are “moderately” optimistic. This group of reviews comprises 154 individual studies designed to evaluate the efficacy of the different treatments described above. Although they differ in sample characteristics, in cognitive variables measured and in the tests used to assess them, as a whole, the majority of studies have reported rehabilitation-related improvement on neurocognition. More specifically, results from computer-based programs have been in many cases encouraging for improving cognitive function, as is the case of NEAR (e.g. Medalia & Freilich, 2008). Examples within the group of cognition enhancing approaches that have shown improvements in neurocognition using CET and CRT are the studies of Hogarty *et al.*, (2004) and Wykes, Reeder, Corner, Williams, and Everitt (1999) respectively. In the case of IPT, their authors have been elaborating their own meta-analysis on the efficacy of that program. The one performed on 2006 (Roder, Müller, Mueser & Brenner, 2006), including 30 studies with the participation of 1393 schizophrenic patients, provided support for the effectiveness of IPT. When compared with the control conditions, the largest effects of IPT were obtained in neurocognitive functioning. The findings for compensatory approaches are consistently positive though few in number. Kern, Green, Mitchell, Kopelowitz, Mintz, and Liberman (2005) applied errorless learning in laboratory-based studies and community settings. Results showed errorless learning training to be superior to conventional instruction. Results in the case

Table 1. Reviews published in recent years on “Cognitive Rehabilitation in Schizophrenia” with the number of studies included in each and the literal conclusions appearing in the review summary.

Review	No. of Studies	Conclusions
McGurk et al., 2007	26	“cognitive rehabilitation produces moderate improvements in cognitive performance and, when combined with psychosocial rehabilitation, it also improves daily functioning”.
Kurtz et al., 2007	13	“Results show that a set of cognitive remediation strategies produce improvements in measures of working memory, verbal memory and executive functioning”.
Pfammatter et al., 2006	5 ^a	“cognitive rehabilitation leads to short-term improvements in cognitive functioning”
Silverstein et al., 2004	3 ^b	“(…) evidence based on its effectiveness is not impressive… it is not clear if cognitive rehabilitation is worth it considering its cost in time and resources”.
Krabbendam et al., 2003	12	“cognitive rehabilitation can improve performance in patients with schizophrenia and this effect is apparent in tasks different to those practised during the training programme”.
Twamley et al., 2003	17 ^c	“distinct approaches (of cognitive training) both with and without the aid of computers have effective components that appear promising in improving cognitive performance”.
Pilling et al., 2002	4	“cognitive rehabilitation does not show benefits in attention, verbal and visual memory, planning, cognitive flexibility and mental condition”.
Suslow et al., 2001	9	“There is no conclusive evidence that attentional training is effective in schizophrenia”.
Kurtz et al., 2001	18	“With regards to executive-function (…) performance can be improved on a variety of variables (Wisconsin Card Sorting Test) (…) with regards to attention, serial scanning can be improved (…) evidence is mixed (…) with respect to sustained attention…”

a: these five studies include together a total of 52 studies.

b: this is not strictly a review but presents the point of view of the authors on an important topic (Cognitive Rehabilitation in Schizophrenia) at the request of the Schizophrenia Bulletin Review.

c: the review focuses on computer-assisted rehabilitation programmes.

of CAT, another compensatory cognitive remediation program, in a series of randomized studies (e.g. Vellingan, Kern, & Gold, 2006) show that it is effective at improving adherence to medication and community functioning through the work performed in executive functioning. Furthermore practically all these reviews end up recommending further studies, with methodological improvements, in order to continue providing data that will allow clearer identification of those treatments that are truly effective.

CONCLUSIONS

There is broad consensus that cognitive ability influences quality of life and conditions a patient’s daily life and his/her adjustment to it. It is also more persistent over time than positive symptoms, more resistant to conventional treatment and is a better indicator and predictor of functional outcome (Green, 1996).

Consequently, literature dealing with the topic demonstrates that the development and use of cognitive training programs has become a key component in strategies treating the illness, especially because of the following:

- a) There are numerous studies demonstrating that cognitive deficits are good indicators for clinical diagnosis (Moritz & Woodward, 2007; Reeder, Newton, Frangou, & Wykes, 2004).
- b) There is a relationship between measures of social functioning, employment functioning and the ability to live independently with cognitive performance (McGurk, Muesser, & Pascaris, 2005; Reeder, Smedley, Butt, Bogner, & Wykes, 2006).
- c) It has been proven that cognitive deficits can interfere with and diminish the results of various psychosocial intervention programs such as the training of social skills, employment rehabilitation and cognitive therapy for persistent symptoms in schizophrenia (Bell & Berson, 2001).

In conclusion, it seems clear that there is considerable interest on the part of researchers and clinics in gaining a deeper, detailed insight into each of the aspects related with the cognitive impairment accompanying schizophrenia and the impact this impairment has, in turn, on social functioning. As a logical consequence, numerous intervention programs are being designed, employed and evaluated, albeit from various different theoretical starting points, with the objective of improving cognition in schizophrenia and, by extension, social functioning. However, many programs still have important unresolved issues where more research is needed. For example, evaluation of effectiveness in global terms but also specific evaluation of each component of cognitive functioning as well identifying the “active ingredients” or program components that most contribute to effectiveness.

At the same time it is worth remembering recommendations such as those from Medalia and Richarson (2005), or those of Velligan, Kern, and Gold (2006) that point out a series of factors contributing to cognitive improvement when it comes to commencing an intervention: patient baseline impairment, intrinsic motivation, working style, factors related with the illness, the symptom profile, medication type, treatment intensity, therapist training and the relations between training and the patient’s characteristics.

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