Cognitive remediation and work outcomes in schizophrenia

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Abstract

Getting and keeping a job are some of the main criteria for recovery in schizophrenia, and are often undermined by cognitive impairments. Cognitive performance is clearly associated with functional outcomes, particularly with the ability to get a job. Reducing the impact of cognitive disorders is therefore necessary to help patients with schizophrenia succeed in their professional integration or reintegration.

Cognitive remediation is the therapeutic tool used to best fight cognitive impairments, by training the impaired functions or trying to reduce their functional outcomes through the development of cognitive strategies. This article reviews the recent literature focused on the vocational outcomes of cognitive remediation when used in association with employment support, and offers to refine its indications depending on specific parameters.

Key words: schizophrenia; recovery; cognitive deficits; executive functions; memory; attention; neuropsychology; social cognition; metacognition; cognitive remediation; vocational outcomes; work functioning; competitive employment; vocational rehabilitation.

1. Factors of vocational outcomes

During the progression of schizophrenia, going back to work is generally considered as a recovery criterion by health professionals and as a major step in the recovery process by the patients. Since recovering from a mental disorder is determined by the patients' 'ability to give a new meaning to their existence and to define new objectives beyond the disability range' (Anthony, 1993), and since getting a job valued by the larger society is one of the three axes of recovery, next to developing an explanatory framework for understanding the experience of the disability and getting control over the illness itself (Spanoil et al., 2002), it comes with no surprise that going back to work is one of the first objectives of patients with schizophrenia. Many patients think that work is a self-esteem and social skills restoration factor, and also a way to be more responsible and satisfied (Provencher et al., 2002 ; McGurk et al., 2009). But the wish to go back to work, derived from this representation, is far from being granted to everyone, since less than 20% of patients with schizophrenia have a job (Marwaha et al., 2007).

These data highlight the factors impairing the ability to find and to keep a job. Among these factors, cognitive disorders, product addiction and somatic diseases have been identified as the main integration-limiting comorbidities (McGurk et al., 2009, Harvey et al., 2004). Cognitive disorders appear to have larger vocational outcomes than the positive and negative symptoms of schizophrenia (McGurk et al., 2004).

Cognitive skills and motivation are predictors of good vocational outcomes in people with schizophrenia (Choi et al., 2013). People with a lower level of cognitive functioning tend to show weaker performance at work or have less complex occupations (Lystad et al., 2016; Saavedra et al., 2015) and may be more at risk to lose their job. Several studies highlighted cognitive impairments as predictors of the inability to get or keep a job.

For example, a follow-up study after the first episode of schizophrenia showed that going back to work or school less than 9 months after clinical stabilization was predicted at 52% by 3 cognitive factors: working memory; attention and early perceptual processing; verbal memory and processing speed (Nuechterlein et al., 2011). Attention and working memory impairments are thought to be directly linked to the inability to perform a professional activity efficiently (Bowie et al., 2010).

Chang et al. (2014) studied the predictors of vocational outcome in people

with schizophrenia. They conducted a 3-year follow-up study on a cohort of Chinese patients with a first episode of schizophrenia-spectrum disorder, to study the employment rate and identify the early clinical and cognitive predictors of vocational outcome. Their findings showed that executive functioning (measured by MWCST; Nelson, 1976) may be a critical predictor of vocational outcome in the early course of schizophrenia, even though it is less consistent than in chronic samples (Rinaldi et al., 2010). Executive functions impairment, which have consequences on social behavior, but also processing speed and verbal memory impairment, linked to a reduction in the quality of social exchange, may have an indirect negative impact, since relationship parameters play an important role in the workplace.

In this context, Reddy et al. (2014a) showed that social cognition (measured with a tool assessing the emotional regulation during social situations) and processing speed are the most predictive cognitive factors of job and salary stability in veterans with schizophrenia who participate in an employment support program. They stressed that the impact of social cognition on the professional life needed to be more broadly investigated to offer targeted interventions (in association with social skills training) and improve vocational outcome.

It is true that cognitive impairments may have deleterious effects on employment, but it goes both ways. In a recent single-and-multi-variable regression analysis of many potential predictors of cognitive functioning (at baseline, for measures observed 10 years later), unemployment was identified as a significant predictor of poor cognitive functioning in a population of adults with schizophrenia (Bergh et al., 2016). Thus, it appears relevant to think that it may become harder to mobilize cognitive skills that are rarely used due to a long period of unemployment.

Cognitive remediation, as part of an employment support strategy, could then be as important as training specific skills to help cognitive remobilization after a ”slow “ period.

2. Principles and objectives of cognitive remediation

Cognitive remediation is listed in the non-medicated therapeutic tools, and aims to reduce the impact of cognitive impairment. In psychiatry, particularly when treating schizophrenia, and beyond the scope of vocational outcome, it is often necessary to complete the effect of psychoactive drugs and psychotherapy with

cognitive remediation (Kurtz et al., 2012 ; Vidailhet et al., 2013) . Cognitive disorders associated with schizophrenia heterogeneously impair neurocognition (memory, attention and executive functions), metacognition (one‘s representation and control of their own cognitive functioning) and social cognition (the representation of other people‘s cognitive functioning and emotions) (Kurtz et al., 2012). They contribute directly or indirectly (playing a role in symptoms creation) to the reduction of autonomy and functioning. Cognitive remediation needs to be systematically preceded by an integrative assessment. This assessment is used to link cognitive impairments with their functional outcome and to identify preserved skills. It helps the patients better acknowledge their abilities and difficulties, and thus recover.

Vocational outcome, as social life and leisure, is rarely satisfying if cognitive functioning is impaired and this impairment has not been compensated. Cognitive impairment generally causes a decline in key abilities used in the workplace, particularly the ability to remember instructions, to interact appropriately and to guide one‘s choices and behavior in an efficient way (Addington et al., 1999). It is therefore important to identify and quantify potential cognitive impairments as early as possible to pave the way for cognitive remediation, if necessary.

The reduction of the cognitive impairment impact on the patients’ everyday functioning, achieved using cognition remediation, is particularly necessary to improve the ability to have a professional activity, be it a sheltered or competitive employment[1]. This benefit may be obtained with either a reduction or a compensation of cognitive impairments. Reduction is achieved by training impaired functions, whereas compensation consists in developing alternate skills involving preserved functions. Either way, cognitive remediation is a treatment tool helping to reduce the real impact of cognitive impairments, by making a better use of preserved skills (Demily & Franck, 2008; Franck et al., 2013a). To aim for professional integration – or reintegration –, it is important to establish concrete links between the nature of exercises performed in sessions and the potential or proven difficulties that may arise in a work environment.

Reddy et al. (2014b) showed that every cognitive remediation (CR) strategies did not have the same functional outcomes. They conducted a review of the recent

[1] Competitive work: Jobs paying minimum wage or higher, “owned” by the individual (and not the agency), not set aside for a person with a disability, and integrated in the community.

literature (2011-2013) focused on people with schizophrenia. They showed that what patients learned was better generalized both to untrained neurocognitive processes and functional processes (objectives reached in everyday life), when CR focuses on higher-level cognitive processes (16 studies analyzed), compared to CR strategies focused on neuroplasticity by over-training lower-level processes (5 studies analyzed).

Cognitive performance improvement is however an intermediary variable, the final objective being everyday functioning improvement, which includes improving or recovering the ability to work, if necessary.

The cognitive improvements observed after cognitive remediation are not all correlated with an improvement in vocational outcome, as showed in a study by Wykes et al. (2012), in which developments have been observed in three cognitive processes (memory, flexibility and planning) in employed patients (paid or not), even though the only factor predicting an improvement in job adaptation was planning (Wykes et al., 2012). This result confirms it is important, not only to look for cognitive improvement, but also to wonder from the start how this improvement may benefit the vocational outcomes.

Learning new strategies needs to be associated with the use of said strategies in a professional situation (or during the preparation to go back to work), to help generalize the benefits. The transfer of skills requires not only to repeat exercises as much as necessary during sessions close enough in time (generally two or three sessions a week), but also to prescribe duties to do at work or during therapeutic workshops. Since transfer is a very specific function (McGurk et al., 2016), improving a given cognitive process has a larger impact only if concrete objectives have been firmly linked to what has been learned during sessions. It is important that neuropsychologists and therapists involved in cognitive remediation meet the persons who are every day in contact, on the workplace, with patients with psychic disorders who are actively looking for a job. It is also necessary that patients be present during these meetings. This will first help neuropsychologists and therapists offer an optimized treatment by choosing the most relevant exercises depending on the concrete objectives set by the patients and, second, help employment supervisors support the patients in successfully performing the required tasks, by taking the patients' limits into account and gradually increasing the difficulty.

To improve integration, it is important that cognitive remediation impacts the specific cognitive functions

involved in the targeted work position (Contreras et al., 2012). For example, a patient with episodic memory impairment and subsequent difficulties to remember instructions given by his boss would benefit from item memorization exercises with progressive difficulty. Job instructions would also be repeated in the workplace and their encoding would be checked. Another patient with visuo-spatial functioning impairment and difficulties to work as a horticulturist would receive exercises to learn how to systematically structure her perception. Computerized exercises and exercises inside the flower area (a greenhouse or a flower shop) would use the same reference points and the same ordered approach of information.

Many controlled clinical trials (Franck et al., 2013a; Roder et al., 2006; Wykes et al., 2007), and a meta-analysis (Wykes et al., 2011) summing the results of studies involving more than 2 100 patients with schizophrenia, have demonstrated that cognitive remediation was correlated with a durable performance improvement in neuropsychological assessment and functional outcomes. These studies also highlighted the larger vocational outcomes of cognitive remediation if it is associated with other rehabilitation tools and relies on learning new strategies to cope more effectively with the situations the patients face.

3. Vocational outcomes of cognitive remediation

The ability to go back to work is perceived by patients with a psychic disability as an essential step on the way to recovery (Provencher et al., 2002).

IPS (Individual Placement and Support) is one of the most widespread standard tools developed in the last decades to help patients go back to work. First experimented in the USA and Canada, the IPS program (Bond et al., 2012) is now implemented in almost every Anglo-Saxon and European countries, and is starting in Asia. Its effectiveness was proven by over twenty randomized trials conducted all over the world. It relies on the following principles: participation in the program on a free choice without exclusion criteria, personal wishes taken into account, job seeking in the short term without professional re-training, with priority to a competitive employment, advices on social services, support not limited in time, and coordinated action between mental health professionals, integration supervisors and employers. IPS proved its effectiveness during several controlled trials (Mueser et al., 2014). According to a recent publication, patients who participated in this program showed a 61% employment

rate, whereas this rate falls to 23% with other employment support programs (Bond et al., 2008). These results largely promote IPS, but 40% of patients still fail to find a job and those who find one are generally unable to keep it in the long term - the mean time for a first employment by IPS is approximately 10 months (Bond et al., 2008).

These data have encouraged the search for tools to associate with employment support programs - including IPS - to improve employment rate and help patients keep their job. The most studied tools - and the only ones studied in controlled clinical trials - are social skills training and cognitive remediation (Boycott et al., 2012).

Boycott et al. (2012) compared aggregate rates of employment and job retention after an employment support program associated with cognitive remediation or social skills training. When an employment support program was associated with cognitive remediation, employment rate increased from 38.2% to 60.5% for patients in the first study (Greig et al., 2007) and from 38.2% to 69.6% for patients in the second study (McGurk et al., 2005). This rate progressed from 61.5% to 82.8% and 94.4% to 89.4% when a social skills training was added. However, job retention improved from 36.17 weeks to 46.94 weeks when associated with social skills training, whereas it did not change when cognitive remediation was used. These data promote the combination of these programs to make employment support more effective.

Interpersonal difficulties cause a reduction in job retention. In this context, it may be interesting to reinforce IPS with work-related social skills training (WSST), which is the building ground of a new type of program: the Integrated Supported Employment (ISE).

Integrative strategies tend to be more frequent, to target a wider range of skills required at work. ”Coupled psychosocial interventions (with proven effectiveness) offer the benefit of targeting several skills at once and may therefore be generalized to other aspects of the patients’ life” (Lecomte et al., 2014). Coupling ISE with cognitive remediation (offering IPS + WSST + CR) therefore became commonplace in the last few years in research on the vocational outcomes of patients with a severe mental illness (SMI) (Au et al. 2015; Tsang et al. 2016; Christensen et al. 2015).

Trials set to highlight how cognitive remediation impacts the professional reintegration of patients with a psychic disorder often studied how it could help as an additional employment support tool. Controlled trials that used cognitive

remediation to improve vocational outcomes, in association with an employment support, are presented in Table 1 (studies published between 2005 and 2016).

We excluded from the Table 1 a recent study from Lee (2013). Indeed, he has conducted a randomized controlled trial on sixty Korean inpatients with schizophrenia who usually performed various simple work. He showed that cognitive remediation (20h over 3 months), added with a usual rehabilitation (including social skills training program, vocational, recreational functioning, and psychoeducation) improved work quality and work habits compared with usual rehabilitation alone. But these results were obtained without follow-up period (i.e. immediately after the intervention period of 3 months). This does not allow to ensure that these improvements were maintained over time. Furthermore, the involved participants occupied simple workstations (such as simple clerical work, fastening with a bolt and sealing an envelope), far from the competitive working criteria.

A meta-analysis was conducted by Chan et al. (2015) on nine studies published between 2005 and 2014 with the aim of combining all the data from published randomized controlled trials, which can increase the statistical power and determine the benefits of computer-assisted cognitive remediation (CACR) in terms of productivity for patients with an SMI. It helped demonstrate that CACR, coupled with an employment support or a work therapy, offer significant improvements in work productivity:

- increased employment rate,

- increased number of days worked every year,

- increased annual income.

However, this analysis highlighted heterogeneity between the studies, on each of these measures. Employment support programs increase annual income but no other variables, whereas work therapy programs help increase employment rate and annual income and appear to be a compelling tool to associate with cognitive remediation.

Table 1: Randomized controlled trials on *computer-assisted* cognitive remediation for unemployed outpatients between 2005 and 2016

Study and location	Diagnosis	Intervention	Cog Remed Type	control	vocational outcomes	res	N	Unemployment condition	Follow up (month)	Duration of computer-based cognitive exercises (Approximately)
McGurk et al. (2005) United States	SMI	CT + SE	TSW using CogPack	SE	Type of each job, hours worked, wages earned, and job tenure	Significant: The CT + SE group held significantly more jobs, worked more hours, and earned more wages than the SE only group.	44	Not currently competitively employed, desire for competitive Work.	12	24h /12 weeks
Vauth et al. (2005) Germany	Schizophrenia *Inpatients during the vocational rehabilitation and outpatients during the follow-up period*	CT + SE or SE + Training of self-management skills for negative symptoms.	CAST + coping cards + errorless learning	SE (graduated job placement in different training sites for up to 15 hours per week)	Rate of successful job placement (part- and full-time employment more than 3 months vs. no useful work)	Significant: CT + SE was 2.3 times as effective in successful job placement as SE only at the 12-month follow-up interval.	138	Unemployed (52.9% of the patients had had no meaningful work in the preceding year).	12	24h/8 weeks (twice weekly for 90 minutes)
McGurk et al. (2007) United States	SMI	CT + SE	Cogpack	SE programs	Total number of jobs; Total number of weeks; Total number of hours; Total wages.	Significant: More patients worked in the CT +SE than the SE And CT +SE held more jobs, worked more weeks and more hours, and earned more wages than in the SE alone.	44	Current unemployed, desire for employment, enrolment in supported employment, history of at least one unsatisfactory job ending.	24 - 36	24h/12weeks
Bell et al. (2008) United States	schizophrenia and schizoaffective patients	CT + SE (vocational rehabilitation)	NET, using CogRehab, (Bracy, 1995) modified + Sci-Learn (Scientific Learning, 2003).	SE (vocational rehabilitation)	Cumulative employment rates; Work hours; Total hours worked (transitional or competitive work).	Significant: CR + SE patients - worked more hours, - reached higher cumulative rate of competitive employment, - maintained significantly higher rates of employment.	72	Participants were classified as work experienced if they had ever held a continuous full time job for at least one year.	12 (after active intervention for 12 months)	up to 10 h per week / 28 weeks (average = 113.75 h (sd SD=94.0))
McGurk et al. (2009) United States	SMI	CT + SE (vocational rehabilitation : Internships and supported employment)	Cogpack + weekly group (cognition and job + problem solving about job)	vocational rehabilitation (internships and supported employment)	Job type; competitive / noncompetitive; hours worked; wages earned.	Significant: CR+SE worked more hours and earned more wages for all types of work compared with SE alone	24	Unemployed, interest in obtaining work, history of unsatisfactory job ending.	24	24 h (45-60 min, usually completing 2 sessions per week) /16 weeks

Sato et al. (2014) First study in Japan	Schizophrenia or Schizoaffective disorder	CT + SE (IPS + traditional supported employment)	TSW using CogPack (japanese version)	SE (IPS + traditional supported employment)	Competitive employment rate; total days employed; total earnings; use of internship programs ; vocational Rehab Program.	No Significant (except More inernship progr for person with disability in SE group)	94	Have any competitive work experience and have intention to find employment at the time of entry.	16	24h/12 weeks training exercises + 12h verbal exercises (transfer); weekly group discussions
Bell et al. (2014) United States	Schizophrenia or Schizoaffective disorder	CT + SE (IPS + work support group)	1/ CogRehab + Sci-Learn 2/ PositScience's Brainfitness and Insight + training tasks	SE (IPS + work support group)	Competitive (cumulative) employment rate; Work hours (Total hours worked over the two-year follow-up period).	Significant only in lower-functioning (compared with higher) in the SE+CR.	175	Unemployed.	24	up to 10 h per week/12 months
Au et al. (2015) First study in China	Schizophrenia or Schizoaffective disorder	CT + ISE (IPS + WSST)	Strong Arm System and Captain's Log	ISE (IPS + WSST group) + recreational activities	Competitive (cumulative) employment rate; job tenure ; salary ; No. of job termination.	No Significant	90	Unemployed, and had competitive employment as their current vocational goal.	11	max 72h/12 weeks (6h per week)
Tsang et al. (2016) China	Schizophrenia or Schizoaffective disorder	CT + ISE (IPS + WSST)	Strong Arm System and Captain's Log	ISE + recreational activities	Cumulative employment rate; longest duration of a job held.	No Significant	90	Have employment history (about 96%).	15	max 72h/12 weeks (6h per week)
McGurk et al. (2015) United States	SMI (SCZ and Schizoaff = 46%)	CT + SE (Enhanced Vocational Rehabilitation)	TSW CogPack	SE (Enhanced Vocational Rehabilitation)	Number of jobs; weeks worked; wages earned; hours worked; weeks to first job.	Significant consistently: better competitive employment outcomes (jobs obtained, weeks worked, and wages earned) in CT + SE than in the SE group.	107	Enrolled in a vocational rehabilitation program but has no work for the past 3 months.	24	12-24h/12weeks
McGurk et al. (2016) United States	SMI	CT + SE (Enhanced Vocational Rehabilitation)	TSW CogPack	SE (Enhanced Vocational Rehabilitation)	Number of jobs; weeks worked; wages earned; hours worked; weeks to first job.	CT + SE patients significantly more likely to engage in work related activities than those in E-VR; No Significant on competitive work or paid employment outcomes.	54	Enrolled in a vocational rehabilitation program but has no work for the past 3 months.	36	12-24h/12weeks

SMI: Severe Mental Illness as determined by the State of New York Office of Mental Health ; CT: Cognitive training or cognitive rehabilitation ; SE: Supported employment / vocational rehabilitation; TSW: Thinking Skills for Work program; CAST (Vauth et al. 2000): Computer-assisted cognitive strategy training ; IPS: Individual Placement and Support ; ISE: Integrated Supported Employment; WSST: work-related social skills training; NET : Neurocognitive enhancement therapy; Cogpack: version 6.0, Marker Software, Ladenburg, Germany.

Among the computerized remediation tools, Neurocognitive Enhancement Therapy (NET) and Thinking Skills for Work (TSW) showed their effectiveness on vocational outcomes. If they are implemented to reinforce employment support, these tools may improve cognitive and professional functioning (Chan et al. 2015, quoted in McGurk, 2016). These programs are not only a training of cognitive functions but also include the learning of metacognitive skills and coping or problem-solving (particularly professional problem solving) strategies. They aim for a better transfer of what was learned, and the reduction of the functional outcomes of cognitive impairments.

Furthermore, spending too much time on a CACR coupled with employment support is counterproductive in terms of professional effort (Chan et al., 2015): the number of days worked and annual income improves after a 24-hour cognitive training, but does not if the training is longer and more intensive (60 to 130 hours, for up to 2 years).

Box 1 provides information on computerized cognitive remediation programs most used in recent studies.

Box 1: Examples of cognitive remediation programs:

Thinking Skills for Work, TSW (McGurk et al., 2005): TSW is intended to patients participating in employment support programs. It is a 24-hour computerized (using CogPack) individual training, spread over 12 weeks, with the aim of improving cognitive functions. In parallel, the patients consult an employment specialist who helps them target jobs or modify their work environment depending on the patients' progress in the cognitive remediation training. It is divided into 4 component parts: Assessment, Computer Cognitive Training, Job Search Planning, Job Support Consultation.

Neurocognitive Enhancement Therapy, NET (Bell et al., 2001): NET is based upon models of neuroplasticity that call for intense and repetitive practice in order to remediate impaired neurocognitive functioning. The NET program is a computer-assisted training on attention, memory and executive function tasks, with up to five hours a week, for 26 weeks; it also includes a weekly information processing group and feedbacks on the cognitive performance in the workplace. Patients are paid to do cognitive exercises.

Cognitive Enhancement Therapy, CET (Hogarty et al., 2006): The CET program is a performance-based, comprehensive developmental approach to the rehabilitation of social cognitive and neurocognitive impairments. Patients work at their recovery by participating in structured groups and using computer-assisted exercises (45 social cognitive group sessions and 16 computer-assisted exercises in neurocognitive training with progressive difficulty).

Computer Assisted Cognitive Strategy Training, CAST (Vauth et al. 2000): quoted in Vauth et al. (2005): "CAST focused on deficits in sustained and selective attention, verbal memory, and planning. CAST comprises three steps based on Anderson's Adaptive Control of Thought Model (ACT; Anderson 1983). First, components of strategies are discussed (declarative stage). Next, there is repeated practice of these strategies on prototypical situations (i.e., repeating instructions of a job coach by verbalizing; proceduralization stage). Finally, training of its generalization to new situations occurs (tuning stage)".

To help the vocational outcomes of patients, it is necessary, to identify, among people with an SMI, those who will benefit the most from this program and those who will not.

In this context, Bell et al. (2014) showed in an analysis the benefits of associating an employment support program, such as IPS, with cognitive remediation, particularly in people with a low level of functioning in the community. They analyzed two randomized, single-blind controlled trials (Bell et al., 2008) focused on people with schizophrenia looking for a job. These patients received employment support alone (ES) or in association with cognitive remediation (ES+CR). They were distributed depending on their quality of life, which reflects their level of functioning in the community. Employment rate and the total number or hours worked were measured over a total period of two years (one-year intervention and one-year follow-up). Analyses showed that people with a poor quality of life were 2.5 times more likely to find a job and the number of hours they worked was 1.5 times higher if cognitive remediation was associated with employment support (CR+ES) compared to the control group (ES). No significant change was reported in patients who better function in the community. It is also interesting to report that the group receiving the ES+CR intervention was also more impacted in measures of PANSS on negative symptoms, cognitive symptoms and hostility.

Therefore, associating cognitive remediation to an employment support program appears to effectively improve vocational outcomes of patients with a low level of functioning in the community, whereas it does not seem necessary for patients with a good functioning and already receiving an employment support.

McGurk et al. (2015) focused on patients with an SMI for whom employment support was ineffective, despite being coordinated by professionals trained to identify the level of cognitive functioning and adapt to it. They showed at first that these patients benefited in the long term (results are retained after 2 years) from cognitive remediation, in terms of salary and professional competitiveness (with at least the minimum wage and jobs not offered by employment services and not reserved for disabled people). However, a more recent study, conducted over 3 years and reporting less significant findings, led the authors to realize the importance of taking into account the level of education (McGurk et al., 2016). The level of education affects not only the effectiveness of cognitive remediation and retention of these effects, but also the likeliness of finding a job and the hourly salary, favoring people with higher degrees.

More studies are starting in other countries, with diverse socio-demographic contexts, such as China, Japan or Denmark (Tau, 2015; Tsang, 2015; Sato et al., 2014; Christensen et al., 2015), and will offer a better understanding of the conditions and effectiveness limits when implementing such programs, associating employment support with cognitive remediation. Some hardly give any significant results, since they are still facing a lack of experience by professionals in employment support and cognitive remediation, too short follow-up periods or an insufficient implementation of individual care (Sato et al., 2014). Some others need to readjust their inclusion criteria (recruit patients with more obvious cognitive impairments), increase their sample sizes or redesign control groups in their protocol (Au et al., 2015; Tsang & Bell, 2016).

At least two studies are in progress in Denmark and in France. In Denmark, a first multi-centered, randomized controlled clinical trial, in progress (Christensen et al., 2015), is set to compare 3 groups: IPS, IPS+TSW-CR and a control group (usual care without intervention), on professional variables (such as the number of hours worked in competitive employment, number of hours in class, or salary) and clinical variables. Their experimental group includes not only a cognitive training, via computer-assisted exercises, but also a social skills training and exercises to

develop strategies to fight cognitive impairment. This trial is promising since it includes a large sample (750 patients) and a rigorous methodology. In France, RemedRehab is a randomized controlled trial on the vocational outcomes of cognitive remediation in patients with schizophrenia (Franck et al., 2013b). It uses a cognitive remediation tool with an ”ecological strategy" (RECOS program, Vianin, 2013). The computerized re-training of impaired cognitive functions has clear objectives, thanks to strategies encouraging the transfer of the benefits in the patients’ everyday life. Furthermore, this trial requires, in its inclusion criteria, not only the presence of cognitive impairments but also their functional outcomes and the patients’ neurocognitive complaint, refining the clinical indications for remediation. It will help measure the vocational outcomes of cognitive remediation, not only on general variables such as attendance and punctuality at work, but also on the professional performance and behavior (taking initiatives, applying instructions, ability to adapt to changes or to different positions, work speed, ability to work in a team, etc.) This should also help identify correlations between the impaired cognitive functions and diverse work skills.

4. Conclusion and perspectives

Cognitive remediation proved effective if set to reinforce employment support programs and should be offered for every patient with a psychic disorder characterized by a cognitive impairment with functional outcomes, whatever the chosen professional orientation and the disease duration. Its large distribution, in the same way as other psychosocial tools with proven effectiveness, is now a major public health issue (Mueser et al., 2013; Franck et al., 2013), since it helps reduce the stigmatization of the mental illness and the financial cost of care and social help systems.

It is necessary to use tools adapted to every patient‘s needs and clinical picture (Demily et al., 2008; Medalia et al., 2013), as part of an individualized treatment coordinated by a pluridisciplinary team. A single computerized cognitive training, with standard implementation, is not enough to transfer the benefits of neuropsychological measures in ”real life“. It appears essential to effectively improve and redefine cognitive remediation tools by integrating necessary transfer strategies affecting the functional outcomes.

Recent studies suggest that cognitive remediation needs to be offered in reinforcement of employment support programs, particularly for patients:

- who have yet to find a job despite participating in employment support programs (McGurk et al., 2015; McGurk et al., 2016);
- who have a sufficiently high education level, which helps cognitive remediation and is a predictor of vocational outcomes (Saavedra et al., 2015);
- who receive a work therapy (Chan et al., 2015);
- who receive an ES program such as IPS, with or without a social skills training (ISE), even though in the latter case, studies suggest that CR does not show additional improvements when cognitive impairments are mild (Au et al., 2015; Tsang et al., 2016) or when patients function well in the community. However, improvements are significant for patients who poorly function in the community (Bell et al., 2014), i.e. when the functional outcomes of the disease and cognitive impairments are the most disabling.

There are still many obstacles to refine the indication criteria necessary to get the reliable and accurate data needed for cognitive remediation orientation. There is still a long way to extend the current knowledge on the subject and to find the best combination of services depending on the patients 'individual characteristics.

It is still sometimes complicated to demonstrate the effectiveness of associating CR to employment support programs due to the diversity of:

- the offered remediation strategies;
- the studied populations;
- the skill levels of professionals involved in the treatment, be it employment support or cognitive remediation;
- follow-up durations;
- the socio-economical contexts (depending on the countries and periods).

The studies rarely mention, in their indication and effectiveness criteria of cognitive remediation, whether they take into account the cognitive complaint and the functional outcomes of cognitive impairments. Tools such as SSTICS (Stip et al., 2000) or MIC-CR (Saperstein et al., 2008), to measure the complaint, or the ERF (Vianin, 2016), to measure the functional outcomes, are expected to improve the quality of inclusion criteria and yield more significant results, by better targeting the requesting people who really need cognitive remediation. Furthermore, neuropsychological measures could be completed by systematically using work

skills observation scales, which may provide key additional information to understand the links between cognitive and professional functioning. This would help to better ponder the effectiveness of cognitive remediation on vocational outcomes.

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