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ARTICLE

Cognitive Remediation and Vocational Rehabilitation

Susan R. McGurk
Dartmouth Medical School

Til Wykes
Kings College London, London, UK

Persons with severe mental illness (SMI) who are striving to improve their work prospects are often hindered in work endeavors because of difficulties with cognitive skills, such as paying attention or concentrating, learning and remembering information, responding in a reasonable amount of time to environmental demands, and planning ahead and solving problems. In addition to limiting work functioning, cognitive impairments are obstacles to receiving the full benefits of vocational rehabilitation, including supported employment. Efforts to improve cognition in people with SMI, or cognitive remediation, have produced modest but consistent gains in a variety of cognitive domains. More recent efforts have focused on combining cognitive remediation with vocational rehabilitation in order to improve work functioning. Initial results from four published studies of combined cognitive remediation and vocational programs are encouraging, indicating improvements in both cognitive and work functioning. The approaches to cognitive remediation used in these studies vary considerably, as do the characteristics of participants, the vocational rehabilitation models, and the methods of combining cognitive and vocational therapies. The differences in key components of programs combining cognitive remediation and vocational rehabilitation indicate the need to replicate findings, and raise important questions about what aspects of the programs are associated with improvements in work.

Keywords: supported employment, cognitive remediation, vocational rehabilitation, schizophrenia

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Most people with severe mental illness (SMI) have cognitive impairments which, unlike psychotic symptoms, tend to be stable over time and do not respond to currently available pharmacotherapy. Impairment in most areas of cognitive functioning has been demonstrated, including attention, psychomotor speed, working memory, verbal learning and memory, and executive function (Gold & Harvey, 1993; Goldberg et al., 1995; Saykin et al.,

1994). Moreover, the cognitive impairments that are pervasive in SMI have functional significance (Green, 1996; Mueser, 2000). For example, clients who have more severe cognitive deficits are more likely to be chronically institutionalized (Harvey et al., 1998), have impaired social skills and social functioning (Allen, 1990; Mueser, Blanchard, & Bellack, 1995; Penn, Mueser, Spaulding, Hope, & Reed, 1995), have poorer self-care skills (Harvey, Sukhodolsky, Parrella, White, & Davidson, 1997; Wykes, 1994), and benefit less from psychiatric rehabilitation (Bowen et al., 1994; Kern, Green, & Satz, 1992; McGurk, Mueser, Harvey, Marder, & LaPuglia, 2003; Mueser, Bellack, Douglas, & Wade, 1991; Silverstein, Schenkel, Valone, & Nuernberger, 1998; Smith, Hull, Romanelli, Fertuck, & Weiss, 1999; Wykes & Dunn, 1992; Wykes, Sturt, & Katz, 1990). Because of the importance of cognitive functioning for community outcomes, deficits in cognitive abilities may account for some of the life-long disability in people with SMI.

An increasing number of studies have found that cognitive impairments profoundly limit work functioning in people with SMI. For example, the relationship between cognition and work outcomes has been evaluated in cross-sectional comparisons of employed vs. unemployed clients (McGurk & Meltzer, 2000; McGurk & Mueser, 2004; Meltzer, 1999), retrospectively in clients with good vs. poor vocational outcomes (Bellack, Gold, & Buchanan, 1999), and prospectively (Gold, Goldberg, McNary, Dixon, & Lehman, 2002; McGurk & Mueser, 2004; Mueser, Salyers, & Mueser, 2001). Despite differences in methods across these studies, a consistent pattern has emerged from this literature that better cognitive functioning predicts better work outcomes (McGurk & Mueser, 2004). Furthermore, impaired cognitive functioning predicts worse employment outcomes in clients receiving vocational rehabilitation services (Bell & Bryson, 2001; Bryson, Bell, Kaplan, & Greig, 1998; Lysaker, Bell, Zito, & Bioty, 1995), including supported employment (McGurk et al., 2003; Mueser, 2002), an evidence-based practice for improving work outcomes in SMI (Bond, Drake, & Becker, 2008). Thus, problems with cognitive functioning have been strongly linked to vocational adjustment in clients with SMI, and appear to compromise response to supported employment and other approaches to vocational rehabilitation.

Enhancing Cognitive Functioning

Because of the importance of cognitive functioning to work in people with SMI, it has become a focus of research in vocational rehabilitation. Efforts to improve cognitive functioning, or *cognitive remediation*, evolved from applications in the rehabilitation of people with brain injury (Benedict, 1989; Butler & Namerow, 1988) to a promising treatment for cognitive impairment in persons with SMI. Current approaches to cognitive remediation include paper and pencil exercises, or more commonly, computerized tasks, designed to provide practice of cognitive skills in order to restore or improve skills. This *drill and practice* approach typically involves repetitive tasks that target a broad domain of cognitive functions, such as through the presentation of information that must be attended to, remembered, or for which a rapid response is required. Task performance is often monitored by a laboratory facilitator, or *cognitive specialist* who provides encouragement for effort, help with problem-solving tasks that are challenging or frustrating, and positive reinforcement by pointing out progress. Cognitive specialists may also provide instruction, or *strategy coaching*, on methods for improving attention (e.g., talking out loud through a task) or learning (e.g., breaking up material into manageable chunks). A more recent approach in cognitive remediation has been to teach metacognitive processes which focus on building knowledge and ability to use problem solving strategies (Wykes & Reeder, 2005). Most cognitive remediation programs target more than one cognitive domain, provide a minimum of two hours per week of practice, and require three to six months to complete (Twamley, Jeste, & Bellack, 2003). Some programs supplement individualized cognitive exercises with group practice activities (Bell, Bryson, Greig, Corcoran, & Wexler, 2001; Brenner, Bettina, Roder, & Corrigan, 1992; Hogarty et al., 2004; Spaulding, Reed, Sullivan, Richardson, & Weiler, 1999).

The rationale for cognitive remediation has been based mainly on the relationship between cognitive functioning and community adjustment. But, somewhat surprisingly, most studies of cognitive remediation have evaluated its impact on cognitive functioning alone, and not psychosocial functioning. Only recently have a sufficient number of cognitive remediation studies been published to permit a meta-analysis, with the tentative conclusion that it contributes to improved community functioning (McGurk, Twamley, Sitzer, McHugo, & Mueser, 2008).

Combination of Cognitive Remediation and Vocational Rehabilitation

Cognitive remediation has been used to improve the outcomes of vocational rehabilitation programs in four controlled studies, including one study of supported employment. Because of general interest in the combined effects of cognitive remediation and vocational rehabilitation, we briefly describe these studies below and highlight the different approaches to addressing cognitive impairment in the context of vocational rehabilitation.

Bell et al. (2001) evaluated the effects of Neurocognitive Enhancement Therapy (NET), comprised of up to 5 hours of computer training a week for 26 weeks, a weekly social information processing group, and a cognitively-oriented work feedback group, which was combined with a work therapy program at a Veteran's Administration Medical Center. The work program consisted of internships paying half-minimum wage in accommodating settings at the VA, referred to as incentive work therapy, with job coaching and a weekly support group. In addition to payment for work, clients were also paid for completion of NET program sessions. NET plus work therapy was associated with improved performance on measures of executive functioning and working memory compared to work therapy alone. Results from a 6-month follow-up period after the completion of NET indicated that NET participants worked more in the incentive work therapy program, and in another work therapy program at the VA paying competitive wages for work provided through subcontracts (Bell, Bryson, Greig, Fiszdon, & Wexler, 2005).

Wexler and Bell (2005) have also reported the initial findings of combining their NET program with community-based vocational rehabilitation. The vocational rehabilitation (VR) program was a combination of subsidized work and supported employment. NET was increased in length, up to 72 hours of computerized practice delivered over 52 weeks, with provision of daily performance-based monetary rewards in addition to a competitive hourly pay ($7.10) for the cognitive practice sessions. Participants obtained community-based jobs that were subsidized by funds obtained by the researchers from the State of Connecticut. The study is ongoing and work outcomes have not been reported, but in a preliminary analysis of 54 participants with schizophrenia, NET plus VR participants showed significantly greater improvement following 12 months of NET, compared to VR alone on measures of attention, working memory, and executive functioning.

Vauth et al. (2005) developed Computer-Assisted Cognitive Strategy Training (CAST), consisting of an 8-week course of 90 minute, twice weekly groups of 6-8 participants that focused on practice of attention, verbal memory, and planning. The first 45 minutes of each session focused on the development, practice, and generalization of strategies for improving cognitive functioning. For example, participants developed a strategy (e.g., repeating back what the job coach said), practiced it, and generalized the specific strategy to work situations, aided by the use of "coping cards" containing individually-tailored coping strategies for each participant. In the second half of each session participants engaged in computerized practice of a standardized curriculum covering these cognitive domains. In addition, participants were provided guidance on altering their work environment to compensate for cognitive deficits using strategies similar to those described in the Cognitive Adaptive Treatment (CAT) model (Velligan et al., 2002), such as by posting instructions in their work area, and arranging work space to facilitate attention to work tasks. The teaching of coping and environmental strategies used errorless learning techniques (Kern, Wallace, Hellman, Womack, & Green, 1996), which strive to minimize commission of errors because mistakes are believed to be implicitly learned and thus should be avoided to the extent possible.

CAST was implemented during an 8-week inpatient stay for persons with schizophrenia and was combined with a vocational rehabilitation program that included graduated job placement and coaching at different work sites to provide practice of strategies. In a randomized controlled trial of 138 clients in Germany, participation in CAST was associated with significantly better verbal memory and higher rates of job placement 12 months later compared to clients who received training in self-management skills for negative symptoms and vocational rehabilitation, or vocational rehabilitation alone, which did not differ. The measure of job placement combined all forms of paid work, including sheltered and other noncompetitive types of work as well as competitive work; information on hours worked or wages earned was not reported. The findings from this study provide encouraging evidence that integrating cognitive remediation with vocational rehabilitation may improve work outcomes, although the vocational program and service context that this study was conducted at in Germany are quite different than community-based supported employment programs in the U.S.

One study has recently been completed evaluating the effects of a cognitive rehabilitation program and supported employment, called the Thinking Skills for Work Program (McGurk, Mueser, & Pascaris, 2005). This program involves 3 months of twice-weekly computerized cognitive training exercises, as well as programmed in vivo practice of skills and teaching coping strategies for managing persistent cognitive impairments. In addition, the program is integrated into supported employment and provided concurrently with other supported employment activities, including job search and job support. Because many clients benefit from supported employment alone and require no additional services, the program targets clients who have difficulty getting or keeping jobs in supported employment programs.

A randomized controlled trial was conducted comparing the Thinking Skills for Work Program and supported employment with supported employment only in 44 persons with SMI at two sites in an inner-city population. Symptom and cognitive assessments at 3 months indicated significantly greater improvements in cognitive functioning and depression for clients in the Thinking Skills for Work program (McGurk et al., 2005), and better competitive employment outcomes at 2–3 years, including percentage of clients who worked, hours worked, and wages earned (McGurk, Mueser, Feldman, Wolfe, & Pascaris, 2007). This study provides support for the potential benefits of integrating cognitive rehabilitation with supported employment.

The findings from these four studies indicate that combining cognitive remediation with vocational rehabilitation programs is associated with improved cognitive and work functioning. Although the results are promising, they are preliminary, and to date, none has been replicated. As summarized in Table 1, the cognitive programs were multi-faceted, and differed in intensity, duration, and types of computerized task practice, as well as use of strategy coaching and compensatory strategies. Furthermore, the level of difficulty of cognitive remediation exercises in two studies (Bell et al., 2001; Wexler & Bell, 2005) was based on clients' performance on the exercises, while other programs (Vauth et al., 2005; McGurk et

Table 1—Attributes of Cognitive Remediation Programs Combined with Vocational Rehabilitation

Studies	Targeted Population	Measured Outcomes/Length of Follow up	Cognitive Remediation Program	Timing of Cognitive and Vocational Rehabilitation
Bell et al. 2001, 2005	Unemployed VA patients	Paid work in VA work therapy program/ 12 months	36 hours of computerized computerized practice (Bracy, 1995) over 26 weeks, combined with weekly social and work processing groups. Work outcomes included work in work therapy occurring during the 6 months of intervention and a subsequent 6 month follow up.	Parallel computerized practice and weekly groups with work therapy, followed by a 6 month month work follow up.
Wexler and Bell, 2005	Unemployed outpatients with interest in work	Subsidized and competitive work/ 12 months	72 hours of computerized practice (Bracy, 1995) over 52 weeks and weekly social and work processing groups followed by a 12 month work follow up.	Parallel delivery of NET and vocational rehabilitation for 12 months, followed by a 12-month work follow up.
Vauth et al. 2005	Unemployed inpatients	All paid work/ 12 months	8 week cognitive remediation program consisting of twice weekly 90 minute sessions of teaching coping strategies, computerized practice of cognition (Marker, 2005), and environmental modifications in simulated work environments, followed by a 12 month follow up of work.	Sequential delivery of the 8-week cognitive remediation program and a 12-month work work follow up.
McGurk et al. 2005	Enrollment in supported employment; history of job loss	Competitive work/ 2-3 years	24 hours of computerized practice (Marker, 2005) with strategy coaching over 12 weeks; consultation of cognitive specialist with employment specialist regarding timing of job search and on the job compensatory strategies, delivered throughout delivery of supported employment services.	Parallel delivery of cognitive remediation and supported employment services.

al., 2005, 2007) provided a standard curriculum. In addition, there were differences in the inclusion criteria across the studies. Three of the four studies included participants with schizophrenia (Bell et al., 2001; Vauth et al., 2005; Wexler & Bell, 2005), whereas one included clients with SMI (McGurk et al., 2005). One study stipulated history of job loss and enrollment in supported employment as inclusion criteria (McGurk et al., 2005), but the others did not. The studies also differed in the duration of tracking of work activity, the type of work tracked (sheltered, transitional, or competitive), and the methods for combining cognitive remediation and vocational rehabilitation services. Finally, only one study evaluated the impact of cognitive remediation when combined with supported employment (McGurk et al., 2005), the vocational rehabilitation model with the strongest empirical support (Bond et al., 2008). Given the variability across studies in the methods used to deliver cognitive remediation, the duration and types of work tracked, the study inclusion criteria, and the vocational models used, the precise contribution of the different program elements is unknown.

It is also possible that other factors unrelated to cognitive remediation may have contributed to better cognitive and vocational functioning. For example, none of the studies attempted to control for clinician contact time, and thus increased staff attention during cognitive remediation or more work services could have contributed to superior outcomes. On the other hand, a recent meta-analysis of cognitive remediation found that attention-control groups were not associated with decreased effect sizes of cognitive functioning compared to treatment as usual (McGurk et al., in press), suggesting that staff contact alone cannot explain improved cognitive performance.

Research Underway on Other Approaches to Cognitive and Vocational Rehabilitation

Teaching methods based on errorless learning have recently been explored in vocational rehabilitation for severe mental illness. *Errorless learning* is an approach to teaching skills based on the principles of shaping that attempts to minimize the commission of errors by breaking tasks into small component steps, teaching the steps one at a time and gradually increasing their difficulty with repeated practice (Terrace, 1963). In one study, 65 unemployed clients with schizophrenia were randomly assigned to errorless learning training or conventional teaching of two entry-level job task strategies (card filing and toilet tank assembly) for 90-120 minutes in a simulated workshop (Kern, Liberman, Kopelowicz, Mintz, & Green, 2002). Results following training and 3 months later showed that errorless learning was better than conventional instruction at improving productivity, but not speed. In addition, pre-treatment cognitive impairment was related to improvement in performance for the conventional teaching group, but not the errorless learning group, suggesting that errorless learning was able to compensate for the rate-limiting effects of greater cognitive impairment on learning (Kern, Green, Mintz, & Liberman, 2003). These findings suggest that the incorporation of errorless learning procedures into training of skills conducted in supported employment could improve work outcomes. Research is currently underway by this investigator team to incorporate errorless learning into supported employment.

Wykes and Reeder (2005) have developed Cognitive Remediation Therapy, an individual, non-didactic training using errorless learning with immediate feedback, focusing on cognitive flexibility and working memory. In an ongoing, non-randomized open clinical trial in the United Kingdom of a combination of metacognitive approaches (CRT) with rehabilitation, Wykes and Reeder are trying to identify the threshold amount of improvement in cognition necessary to improve work quality and quantity. In this trial, clients receive 3 months of three times weekly cognitive remediation in addition to work programs that include voluntary and sheltered work, and community-based work with provision of job supports and/or work counseling by members of the person's clinical treatment team, such as the case manager.

Twamley and colleagues have developed a cognitive program, Cognitive Training, involving teaching persons with SMI how to compensate for cognitive impairment. Cognitive training involves 12 1-hour sessions focusing on the cognitive domains of prospective memory, conversational and task vigilance, learning and memory, and cognitive flexibility and problem solving. Research is currently underway to evaluate the ability of this compensatory approach to improve community functioning, and to incorporate cognitive training into supported employment.

Future Directions

Two lines of evidence reviewed here suggest that cognitive remediation may improve work outcomes in persons with SMI participating in vocational rehabilitation. First, clients with more severe cognitive impairments tend to benefit less from vocational rehabilitation, including supported employment programs. Second, the results from four controlled studies combining cognitive remediation and vocational rehabilitation show improved cognitive functioning and work outcomes compared to vocational rehabilitation alone. Thus, increasing cognitive skills in the context of vocational rehabilitation may have enabled some

participants to more readily benefit from vocational services.

Although the results of these early studies are promising, the lack of replication of any treatment model and the differences across the studies in vocational rehabilitation approach, cognitive remediation methods, the integration of cognitive and vocational services, study inclusion criteria, and participant characteristics preclude drawing any firm conclusions about the benefits of cognitive remediation for clients receiving vocational services. Consideration of these differences may have implications for future research in this area. Of particular importance is the vocational rehabilitation model that has been used in research on cognitive remediation. Supported employment has the strongest evidence base for improving work outcomes in persons with SMI, with over 15 randomized controlled trials (Bond et al., 2008), but three (Bell et al., 2001; Vauth et al., 2005; Wexler & Bell, 2005) of the four (McGurk et al., 2005) studies employed other approaches to vocational rehabilitation. Therefore, it is probable that at least some of the poor work outcomes of clients participating in other vocational rehabilitation programs can be better explained by the limitations of those models than the cognitive impairments of participants. More research is needed to evaluate the impact of cognitive remediation in clients receiving supported employment.

A related issue is that it is not clear whether the type of vocational rehabilitation model interacts with the cognitive remediation approach. For example, if the demands on work performance and quality are relatively low, such as in sheltered work or some other types of noncompetitive employment compared to competitive work, and vocational supports are readily accessible, then it may be appropriate to emphasize improving attention, memory, and psychomotor speed over teaching metacognitive skills aimed at improving independence. Targeting such higher level, executive cognitive functions may not just serve to improve work performance, but may also provide people with the skills to perform more cognitively complex tasks necessary for moving up the career ladder and obtaining greater monetary compensation in vocational programs where such advancement is possible.

A number of different approaches to cognitive remediation have been developed, all of which may provide good momentum for vocational rehabilitation. With regard to the published studies of cognitive remediation programs and vocational rehabilitation described above, all applied drill and practice techniques, and all produced some degree of cognitive improvement. However, two of these studies supplemented drill and practice with strategy coaching as well as teaching of cognitive coping strategies (Vauth et al., 2005; McGurk et al., 2005). In addition, three other cognitive remediation approaches are being evaluated in the context of vocational rehabilitation, including metacognitive approaches (Wykes), errorless learning teaching approaches (Kern), and an approach based solely on teaching compensatory strategies (Twamley).

It could be argued that a next step would be to compare different approaches to cognitive remediation, and to select the most effective method for improving cognitive functioning to combine with vocational rehabilitation. However, as described above, the efficacy of a particular cognitive remediation program may depend upon the specific vocational model used, suggesting the optimal remediation program cannot be identified in isolation. Furthermore, a meta-analysis of research on cognitive remediation indicated limited variability across programs on improved cognitive performance (McGurk et al., in press), suggesting that even in isolation it may be difficult to identify the most effective cognitive remediation program. Thus, research is needed that examines the effectiveness of different cognitive remediation approaches in the context of specific vocational rehabilitation models, especially supported employment.

Another potentially fruitful avenue of future research is addressing the question of how cognitive remediation improves work outcomes, if indeed it does. Silverstein and colleagues (2005) showed that Attention Processing Training improved the outcomes of social skills training compared to skills training alone, despite not producing gains in cognitive functioning, suggesting cognitive remediation may exert beneficial effects on functioning through mechanisms other than improved cognitive abilities. While cognitive remediation has been found to improve cognitive functioning in people with SMI, other positive effects have also been reported, such as improved self-esteem (Wykes, Reeder, Corner, Williams, & Everitt, 1999), negative symptoms (Bellucci, Glaberman, & Haslam, 2002), and depression (McGurk et al., 2005). It is possible that the benefits of cognitive remediation on work are due more to changes in these other factors than improved cognitive functioning, or that different factors are operative for different clients. Research is needed to systematically examine the role of different possible mechanisms that could mediate the effects of cognitive remediation on work outcomes.

Another issue is to identify who should receive a particular cognitive program. There are several options. Anyone with

Table 2—Thinking Skills for Work Program: Examples of Linking Cognitive Remediation and Work

COGPACK Exercise	Exercise Description	Examples of relevance to jobs	Strategies for improving performance on exercise
Compass	Determining the direction of a compass arrow in which north is the color red	Tour guides, messengers, taxi drivers	Repeat to self the rule "red is north"; draw the compass on paper and rotate
Colors and Labels	Words of colors are displayed in a different color than word depicts (e.g., the word "yellow" " is printed in red ink): Say the color in which the word is printed	The ability to ignore extraneous noise and interruptions: customer service employee solving a problem while others are speaking to him/her, cashier being asked question while ringing up items	Say colors out loud that the word word is printed in to help maintain focus on relevant attribute of stimuli
Eyewitness	Viewing an active street scene and then answering questions questions about the scene	Security personnel monitoring multiple security cameras	Focus on one attribute of scene at a time (e.g., moving vehicles, buildings, people)
Follow up	Determining the next item in a sequence (e.g., Z6Y9X_)	Administrative assistants, clerical work (e.g., filing)	Use paper and pencil to test possible solutions
Information	Look up area codes of countries and type them in; very limited time is given to complete each entry	Airline personnel changing flight reservations, telephone operator, hotel desk clerk	Learn to use the scroller rather than up/down arrow to speed up the search
Labyrinth	Find your way out of a maze without making wrong turns and avoiding dead end alleys	Messengers, courier service, cab drivers, security work and construction personnel (learning building or grounds)	With your eyes or finger, trace a route from the exit through the maze to the entrance; try to remember the route
Memory (shopping items)	Remember a list of shopping items during a distraction filled delay	Wait staff: remembering "the specials of the day" to recite to customers, grocery clerk remembering where to stock items	Chunk items into meaningful bits; use other mnemonics such as putting items in alphabetical order
Piece Work	Determine if items in a moving assembly line differ from template item: Items that differ must be quickly removed from the assembly line	Assembly line work, food service: picking out sandwiches about to be packaged that still need the crusts removed	Look ahead, position finger to make the response when the when the defective item is within reach
Percent	Cut a cake into multiple equal sections	Cutting cakes, pies, or other food items into equal parts in a restaurant or deli	Plan the cuts before they are made. Imagine what the cake will look like divided into (e.g., 7 equal parts)
Route	Devise a plan to connect multiple locations on a street map in the shortest distance possible	Messenger work, cab driver, mail carrier, porter-maintenance collecting trash in scattered locations	Plan first before begin connecting; think through several routes before choosing one
Search	Detect a number (or other object) hidden within a complicated picture	Security personnel studying x-ray scans in the airport	Go line by line or column by column; stick to a particular search strategy

SMI receiving vocational rehabilitation services might be appropriate for inclusion. This is particularly appropriate if the aim is to improve work quality or reduce the vocational services necessary to sustain acceptable work, considering that clients with more severe cognitive impairments require more intensive vocational supports (McGurk et al., 2003). However, cognitive remediation was developed to help those with cognitive difficulties, and focusing on

clients with the most pronounced impairments could be an effective strategy for targeting those persons most likely to benefit, and work, from improved cognition. Alternatively, it might be more efficient to target for cognitive remediation individuals who have experienced difficulties getting or keeping jobs despite vocational rehabilitation, with the assumption that cognitive difficulties lie at the root of many of their work problems. The majority of studies have also concentrated on clients with schizophrenia, although it is possible that cognitive remediation could also benefit people with other diagnoses, given evidence linking cognitive functioning and work in mood disorders (Dickerson et al., 2004).

Studies varied regarding methods of combining cognitive and vocational programs, with some completing computerized practice before beginning work services (e.g., Vauth et al., 2005), and others providing these services concurrently (e.g., McGurk et al., 2005). The optimal strategy for combining the two approaches is an open question. Concurrent programming may provide more opportunities to facilitate the transfer of benefits of cognitive practice to the workplace. In addition, concurrent programming may also provide important opportunities for pinpointing work-related cognitive difficulties that can be targeted in cognitive remediation. Although the studies differed in the timing of cognitive remediation and vocational services, all of the programs had some aspects of "integration" of services. For example, integration strategies included weekly cognitively focused work groups for employed participants (Bell et al., 2005; Wexler & Bell, 2005), practice of compensatory strategies while working (Vauth et al., 2005), the provision of cognitive information to the employment specialist (McGurk et al., 2005), and continued consultation from the cognitive specialist regarding useful compensatory strategies well after the cognitive exercises were completed (McGurk et al., 2005). The Thinking Skills for Work program also linked the computerized exercises with tasks relevant to the client's work or job preferences (Table 2). Providing these linkages to work may also serve to enhance motivation when tasks are experienced as challenging or frustrating.

In summary, four controlled studies combining cognitive remediation and vocational rehabilitation have reported improved work outcomes in persons with SMI. Because all these studies also showed improvements in cognitive functioning, it is tempting to conclude that the cognitive gains were responsible for enhanced work outcomes. However, all the studies differed substantially in the characteristics of participants, ingredients and delivery of cognitive programs, methods of combining cognitive remediation and vocational rehabilitation, and the vocational rehabilitation models themselves, and thus it is difficult to know what the essential contributors to improved work were. Moreover, better work outcomes may have resulted from indirect effects of the remediation programs, such as the availability of more staff time and services to participants enrolled in cognitive remediation, or improvements in depression or self-esteem. Taken together, these preliminary positive effects of cognitive remediation are promising, and warrant further research designed to identify and isolate components of cognitive programs for systematic study of their ability to improve work prospects in persons with SMI.

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Susan R. McGurk, PhD, is Associate Professor of Psychiatry at Dartmouth Medical School. Her research focuses on the relationships of cognitive impairments, vocational rehabilitation and employment in severe mental illness.

Til Wykes, PhD, is Professor of Clinical Psychology and Rehabilitation at the Institute of Psychiatry at King's College London, London, UK, and is also the first Director of the UK Mental Health Research Network which hosts mental health studies within health services.

Corresponding Author:
Susan R. McGurk, PhD
Dartmouth Psychiatric Research Center
Main Building
105 Pleasant Street
Concord, NH 03301
Ph: 603-271-5747