Mental Health System Funding of Cognitive Enhancement Interventions for Schizophrenia: Summary and Update of the New York Office of Mental Health Expert Panel and Stakeholder Meeting

Susan R. McGurk and Kim T. Mueser
Boston University

Keith D. Cicerone
New Jersey Neuroscience Institute, JFK Medical Center, Edison, New Jersey

Robert E. Drake
Dartmouth Medical School

Steven M. Silverstein
Rutgers-University Behavioral HealthCare, Piscataway, New Jersey

Alice Medalia
Columbia University Medical Center, New York, New York

Robert Myers
New York State Office of Mental Health, Albany, New York

Alan S. Bellack
University of Maryland School of Medicine

Morris D. Bell
Yale University School of Medicine

Susan M. Essock
Columbia University and New York State Psychiatric Institute, New York, New York

Topic: A growing research literature indicates that cognitive enhancement (CE) interventions for people with schizophrenia can improve cognitive functioning and may benefit psychosocial functioning (e.g., competitive employment, quality of social relationships). Debate continues regarding the strength of evidence for CE and related policy implications, such as the appropriateness of funding CE services. Purpose: This paper summarizes and updates a meeting of experts and stakeholders convened in 2008 by the New York Office of Mental Health to review evidence on the impact of CE for people with schizophrenia and other serious mental illnesses, and addresses whether the evidence base for CE interventions is sufficient to warrant funding. Sources Used: Specific recommendations based on the extant literature are provided regarding the structure and components of CE programs that should be present in order to improve cognitive and psychosocial outcomes and therefore merit consideration of funding. Conclusions and Implications for Practice: These recommendations may serve as a starting point in developing standards for CE programs. Establishing evidence-based practice standards for implementing CE interventions for people with serious mental illnesses may facilitate dissemination of programs that have the greatest potential for improving individuals’ functional outcomes while minimizing incremental costs associated with providing CE services. Important open questions include how the performance of CE programs should be monitored and which individuals might be expected to benefit from CE as evidenced by improved functioning in their everyday lives.

Keywords: cognitive remediation, cognitive rehabilitation, severe mental illness, psychiatric rehabilitation, traumatic brain injury
Cognitive functioning has high relevance to interventions for people with schizophrenia and other serious mental illnesses. Impaired cognitive functioning increases the likelihood of developing a serious mental illness (Zammit et al., 2004), and people with schizophrenia-spectrum disorders typically experience deterioration in cognitive functioning before their first psychotic episode (MacCabe et al., 2013), which subsequently stabilizes (Addington & Addington, 2008; Heaton et al., 1994; Kurtz, 2005). Impaired cognitive functioning in people with serious mental illnesses is strongly related to poorer functioning in areas such as work and school, social relationships, and self-care and independent living skills (Green, 1996; McGurk & Mueser, 2004), and less benefit from psychosocial treatments (Kurtz, 2011; McGurk & Mueser, 2004; Silverstein, Maxey, & West, 1994; Silverstein, Pierce et al., 1998; Silverstein, Schenkel, Valone, & Nuernberger, 1998).

Because of the relationship between cognitive and psychosocial functioning in schizophrenia and other serious mental illnesses, the development of interventions to improve cognitive functioning as a means of improving real-world functioning is a much-aspired-to goal. A growing number of treatment programs and small businesses have been developed to address this need, with associated requests by providers for payment for such interventions. These interventions, collectively referred to herein as cognitive enhancement (hereafter, CE), are also called cognitive remediation, cognitive rehabilitation, and cognitive training.

In the Spring of 2008, the New York State Office of Mental Health (NYSOMH) convened a panel of experts to summarize the evidence base on CE. The goal was to examine the evidence as to whether these interventions improve cognitive functioning, the extent to which enhancements in cognitive functioning improve psychosocial functioning, and whether the evidence on the functional impact of these interventions was sufficient to warrant including them among rehabilitative services paid for by NYSOMH.

Included in this panel were experts in CE in schizophrenia and psychiatric rehabilitation for persons with serious mental illnesses. Because many treatment methods used for people with schizophrenia were developed from those used for people with traumatic brain injury or stroke, the panel also included an expert in CE for these conditions. This paper summarizes the material presented at that meeting, the recommendations of the panel for potential payers of CE services, the extent to which more recent research is consistent with the findings of that panel, and future avenues for clinical applications and research.

We begin by defining CE in order to distinguish which types of interventions are included as CE and which are not. Next, we provide a brief history of CE for persons with serious mental illnesses, followed by a description of the methods used to enhance cognitive functioning in this population. We then provide a synthesis of research on CE following traumatic brain injury, and similarly review controlled research on CE for persons with serious mental illnesses. We discuss methodological issues regarding this research literature, and then address the implications of empirical evidence for the funding of CE services for people living with serious mental illnesses. We conclude by suggesting future directions for research on CE interventions for this population.

**Definition of Cognitive Enhancement (CE)**

We adopt the most recent definition for CE proposed by a group of international cognitive investigators at the 2012 meeting of the Schizophrenia International Research Society: “Cognitive remediation is an intervention targeting cognitive deficit (attention, memory, executive function, social cognition, or meta cognition) using scientific principles of learning with the ultimate goal of improving functional outcomes. Its effectiveness is enhanced when provided in a context (formal or informal) that provides support and opportunity for improving everyday functioning” (Cognitive Remediation Expert Working Group, 2012). This definition of CE is very broad and includes programs ranging from those using only computer-based exercises without human interaction to behavioral interventions such as the use of modeling and reinforcement to shape attention in individual or group skills training sessions without computerized or other practice of cognitive exercises. CE is distinguished from programs that endeavor to reduce the impact of cognitive impairment on learning or psychosocial functioning without trying to improve cognitive functioning or the self-management of cognitive difficulties. For example, the use of alternative strategies for teaching psychosocial skills (e.g., work skills), such as errorless learning (Kern et al., 2005), is excluded from this definition of CE. Similarly excluded are interventions in which the environment is modified to cue more adaptive psychosocial behaviors (e.g., organizing and arranging someone’s clothes for them to wear for the week), such as in Cognitive Adaptive Therapy (CAT; Velligan et al., 2008), which is distinguished from other compensatory strategy approaches where the clients are taught to modify their environments for optimal functioning.

Social cognition (e.g., emotion recognition, inferring the thoughts of others) has been a focus of much recent investigation and intervention in schizophrenia. Social cognition is routinely included in discussions of cognition in schizophrenia, as exemplified by the MATRICS initiative, where it was included as one of the seven core domains of cognition in schizophrenia (Green & Nuechterlein, 2004). However, social cognition appears to be relatively independent of most “traditional” domains of cognition, in terms of correlations between scores on social cognition and neurocognition measures (Allen, Strauss, Donohue, & van Kammen, 2007; Bell, Tsang, Greig, & Bryson, 2009; Sergi et al., 2007). The issue of whether to include social cognition in our discussion of CE at this point, as a reflection of the broader issue of whether social cognition should be considered a target of CE as it has traditionally been defined, generated much debate within the panel. While we do not try to resolve the debate here, and note that review of the growing research literature on enhancing social cognition is beyond the scope of this paper, we provide some further discussion on this topic in the Future Directions for Clinical Research section.

**History and Methods of Cognitive Enhancement for People With Serious Mental Illnesses**

A rich history of clinical research dating at least back to the 1960s has aimed at developing and evaluating approaches to CE for people with schizophrenia. Early applications were adapted from programs targeting cognitive sequelae of traumatic brain injury, with subsequent programs specifically designed for people...
with schizophrenia. Across the years, a wide variety of programs have been developed to enhance cognition with the goal of improving psychosocial functioning.

CE interventions vary in their intensity, ranging from daily to weekly sessions, and duration, with program length ranging from a few weeks to years. CE programs also differ in the methods and technology used to improve cognitive functioning, the cognitive domains targeted for enhancement, individual or group format, use of ancillary group processes, and the use of a facilitator. Lastly, and possibly of greatest interest to the current paper, programs differ regarding the relationship of the CE intervention to other psychiatric rehabilitation services.

Most approaches to improving cognitive functioning are based on drill and practice, strategy coaching, or a combination of both. **Drill-and-practice** methods are based on an “exercise model” of remediation positing that repeated practice of basic cognitive tasks improves cognitive functioning. For example, practice of sustained attention is accomplished in the COGPACK software program (Marker Software, www.cogpack.com) through an exercise involving the rapid presentation of words belonging to different categories (e.g., vehicles, seasons, tools), with the participant required to respond each time the category changes. Some programs adapt the level of difficulty of the exercises to participants’ specific levels of impairment, such as the CogRehab software. **Strategy coaching** involves providing individually tailored suggestions to improve performance on cognitive exercises. For example, in order to learn a list of shopping items without the use of paper and pencil, a person may be taught to group the items into categories based on salient characteristics (e.g., food vs. nonfood items). The individualized nature of strategy coaching requires the use of a program facilitator, as described below.

In addition to providing drill-and-practice and/or strategy coaching, some CE programs also teach **compensatory strategies** designed to reduce the impact of cognitive impairment on functioning and optimize performance on everyday cognitive tasks (Krabbendam & Aleman, 2003; McGurk et al., 2005; Twamley, Vella, Burton, Heath, & Jeste, 2012). For example, people who are disorganized and have difficulty remembering appointments can be taught to use a personal calendar. While the primary focus of compensatory strategies is improving cognitive performance in daily work or living tasks, research on traumatic brain injury suggests that such approaches can also improve cognitive functioning on neuropsychological assessments (Cicerone et al., 2011). For example, an individual might use an alarm to prompt the beginning of a rest break from a task, which may serve to help keep the person on task and avoid lapses in concentration that lead to inefficient work or study. By gradually extending the periods of work or study between rest breaks, the individual’s attention and concentration may improve.

Some drill-and-practice programs are provided with little or no facilitation (e.g., POSIT Science; Fisher et al., 2009). However, most programs involve a facilitator with a variety of responsibilities, such as monitoring and encouraging on-task behavior, providing strategy coaching, teaching compensatory strategies, and facilitating group processes. For example, in the Neuropsychological and Educational Approach to Remediation (NEAR) program (Medalia, Revheim, & Herlands, 2009) the facilitator engages an individual in computer-based drill-and-practice exercises supplemented by strategy coaching. Programs providing both drill-and-practice and strategy coaching tend to involve more facilitation time per individual than those providing drill-and-practice alone, with associated cost implications.

Some CE programs involve groups and the potential efficiencies therein. One approach is for individuals to work at their own pace in small groups, with a facilitator addressing individual issues (e.g., demonstrating a list learning strategy), such as in the NEAR program (Medalia et al., 2009). Another approach is to teach cognitive skills to participants in a group format, such as the training of problem-solving skills in CET (Eack et al., 2009; Hogarty et al., 2004) or Integrated Psychological Therapy (IPT; Brenner et al., 1994). Yet another variation is to have groups designed to foster the generalization of gains made in CE to real-life situations (Lindenmayer et al., 2008; McGurk, Mueser, DeRosa, & Wolfe, 2009).

Lastly, CE programs vary in the degree to which they are provided in combination with a psychiatric rehabilitation approach. Some CE programs are intended to be paired with a specific intervention such as supported employment; others fully integrate the psychiatric rehabilitation into the CE; while others are stand-alone interventions for use at home or in a clinician’s office. For example, the TSW program is provided in combination with vocational rehabilitation (McGurk et al., 2005; McGurk et al., 2009), whereas CET integrates the practice of social problem solving and social–cognitive skills training (Eack et al., 2009), and attention shaping is typically delivered within the context of skills training groups to promote learning of skills (Silverstein et al., 2005; Silverstein, Pierce, et al., 1998; Silverstein et al., 2009), although it can also be run as a standalone intervention. On the other hand, some programs, like CRT (Wykes & Reeder, 2005) and PosiScience (Fisher et al., 2009), have been offered as stand-alone interventions, although they could be combined with psychiatric rehabilitation in future applications.

**Research on CE Following Traumatic Brain Injury**

Cicerone and colleagues (2000, 2005, 2011), have published three comprehensive reviews of research on the effects of CE on people who have experienced a traumatic brain injury or stroke. These reviews assessed 370 studies, including 65 that were either randomized controlled trials (RCTs) or prospective quasi-randomized trials. Practice standards, guidelines, and options were put forth based on these reviews. As the most stringent criteria were
applied to research for establishing practice standards (at least one RCT or prospective quasi-RCT with an adequate sample size, with additional support from less rigorously designed studies), we briefly summarize those standards for the enhancement of cognitive functioning in those areas most relevant to people with serious mental illnesses, including attention, memory, and executive functions, as well as comprehensive programs.

In order to improve attention following traumatic brain injury, the practice standards recommend providing both attention training using drill-and-practice exercises and training in metacognitive skills (e.g., self-awareness, self-monitoring) to facilitate the development of compensatory strategies and foster generalization to daily living. Sole reliance on computer-based practice of attention without the involvement of a clinician is not recommended. For the enhancement of impaired memory, the practice standards recommend a combination of strategy coaching on internally based techniques (e.g., visual imagery) and teaching compensatory strategies using externally based techniques (e.g., using a memory notebook). Drill-and-practice exercises are not included as a practice standard for improving memory functioning. Only one practice standard is established for improving executive functioning—metacognitive training—although training in formal problem-solving strategies (e.g., problem recognition, brainstorming solutions, etc.) is included as a practice guideline (Cicerone et al., 2011).

Recently, comprehensive, holistic programs following traumatic brain injury or stroke (Ben-Yishay et al., 1985) have been recommended as a practice standard for reducing cognitive and functional disability in individuals with moderate or severe traumatic brain injury or stroke (Cicerone et al., 2011). Rather than narrowly focusing on the remediation of specific cognitive impairments, holistic approaches provide a combination of individual and group-based interventions to address cognitive challenges and improve metacognitive skills, interpersonal functioning, and emotion regulation. For example, one comprehensive, holistic program for traumatic brain injury included a total of 15 hours per week of group and individual programming, 3 days per week, over a 16-week period (Cicerone et al., 2008). Eleven hours per week were devoted to group therapies that focused on three specific themes, including cognition (e.g., practice of functional and social problem-solving tasks), communication (e.g., practice of interpersonal skills through role playing, group and videotape feedback, analysis of social situations), and life skills (e.g., teaching compensatory skills such as note taking, development of monitoring strategies for home and the community). Three hours per week of individual meetings with a primary therapist were provided that included a combination of CE, relating the individual and group treatment to everyday functioning, and counseling to address vocational, educational, or psychological issues. Clients also met individually with a neuropsychologist 1 hour per week to review progress, and to identify and address needs related to cognitive difficulties. The individual and group work emphasized the integration of the cognitive, emotional, and interpersonal interventions in order to promote adaptation to any persisting effects related to the traumatic brain injury and to optimize everyday functioning.

Research also suggests that CE is effective both during the acute period after traumatic brain injury or stroke and many years later. Although people show substantial gains within the first 6 months postinjury related to the natural course of recovery, significant improvements in community functioning continue to be evident several years after injury (High, Roebuck-Spencer, Sander, Struchen, & Sherer, 2006). People with traumatic brain injury who are provided training in compensatory memory strategies even decades postinjury show a significant decrease in memory problems (Ownsworth & McFarland, 1999). Comprehensive CE programs for traumatic brain injury have been shown to improve cognitive functioning, productivity, and life satisfaction of people who are more than 1 year post injury, many of whom were several years postinjury and had been unsuccessful in attempts to resume aspects of functioning prior to rehabilitation (Cicerone et al., 2008).

In summary, controlled research with people with traumatic brain injury or stroke supports the effectiveness of CE for improving cognitive and psychosocial functioning. The research points most strongly to the importance of strategy coaching, teaching compensatory skills, training in metacognition, and embedding CE efforts within a more individualized, comprehensive, and holistic program aimed at facilitating interpersonal functioning, emotion self-regulation, and developing a meaningful life despite any persistent impairments. It is interesting that in the traumatic brain injury literature, drill-and-practice cognitive exercises are recommended as a practice standard only for the enhancement of attention, and only when combined with other CE methods such as strategy coaching and developing compensatory skills.

The needs of persons with traumatic brain injury and schizophrenia for interventions targeting cognition might be very different. People with traumatic brain injury are more likely than those with schizophrenia to have unimpaired premorbid cognitive functioning, and their remaining intact cognitive skills may facilitate greater learning of compensatory strategies. As impaired cognitive functioning typically is of longer duration and more pervasive in people with schizophrenia, the “boosting” of cognitive functioning via computer-based (or other) exercises may be a way to obtain maximum gains from other CE strategies, including teaching compensatory strategies. In short, the practice standards for treating cognitive deficits in schizophrenia can be informed by those for traumatic brain injury, but require further empirical determination from studies of people with schizophrenia.

Research on CE for People With Serious Mental Illness

Over 40 randomized controlled trials have been conducted evaluating CE programs for people with serious mental illnesses, with frequent reviews of this literature (Krabbendam & Aleman, 2003; Kurtz, Moberg, Gur, & Gur, 2001; Medalia & Choi, 2009; Pilling et al., 2002; Twamley, Jeste, & Bellack, 2003). Two meta-analyses have recently been conducted of this controlled research, including 26 and 40 studies (McGurk, Twamley, Sitzer, McGurk, & Mueser, 2007; Wykes, Huddy, Cellard, McGurk, & Czobor, 2011). The primary findings of these meta-analyses were very similar. Both found moderate effect sizes for CE on cognitive functioning ($d_s = .41$ and .45, respectively) and psychosocial adjustment ($d_s = .36$ and .42, respectively) and small but significant effect sizes for symptoms ($d_s = .28$ and 18, respectively).

There were no consistent moderators across both meta-analyses of the effects of CE on cognitive functioning or symptoms (McGurk, Twamley et al., 2007; Wykes et al., 2011). However,
there was an important moderator of the impact of CE on psychosocial functioning: the provision of adjunctive or integrated psychiatric rehabilitation (e.g., social skills training, vocational rehabilitation) in addition to the CE program. Specifically, studies that evaluated the effect of either adding CE to psychiatric rehabilitation or integrating the two together versus psychiatric rehabilitation alone demonstrated significantly greater improvements in psychosocial functioning ($d$s = .47 and .59, respectively) than studies that examined the effects of adding CE to usual services versus usual services alone ($d$s = .05 and .28, respectively). Table 1 summarizes all of the programs from the Wykes et al. (2011) meta-analysis that provided CE and psychiatric rehabilitation.

The apparent moderating effect of psychiatric rehabilitation on the impact of CE on psychosocial functioning raises the questions of how the two intervention approaches may overlap, how they may complement one another, and the extent to which an adequate psychosocial platform may be a prerequisite for obtaining gains in real-world functioning via CE. Improved cognitive functioning due to CE may facilitate the ability of people to learn in psychiatric rehabilitation programs, which in turn leads to greater improvements in psychosocial functioning (Spaulding, Fleming et al., 1999). This is consistent with research showing that cognitive impairment in people with serious mental illnesses is associated with diminished response to rehabilitation approaches such as supported employment (McGurk, Mueser, Harvey, Marder, & LaPuglia, 2003) and social skills training (Mueser, Bellack, Douglass, & Wade, 1991; Silverstein, Schenkel, et al., 1998; Smith, Hull, Ramanelli, Fertuck, & Weiss, 1999). However, as discussed in the next section, there are other aspects of programs that combine CE and psychiatric rehabilitation that may also contribute to improved functioning.

Methodological Limitations and Considerations

As in all research, there are methodological limitations of controlled studies of CE. Some limitations include studies with small sample sizes (e.g., < 10 per group), lack of blinded assessors, limited outcome measures, and lack of follow-up assessment after the program ended (Dickinson et al., 2010). In addition, a few studies have paid people for completing CE exercises, raising questions about the generalizability of findings to “real world” mental health treatment settings where payment for participation in treatment is not customary. However, the Wykes et al. (2011) meta-analysis evaluated the impact of methodological rigor on CE study findings, and found no relationship between study quality and treatment outcomes.

Aside from methodological rigor, there were differences across studies in the choice of a control group, with some using treatment as usual (McGurk et al., 2005) and others including a study arm controlling for either computer training time (Kurtz, Seltzer, Shagam, Thime, & Wexler, 2007; Lindenmayer et al., 2008) or staff time (Wykes, Reeder, Corner, Williams, & Everitt, 1999). The use of treatment as usual as a control condition is not necessarily a methodological limitation, but rather reflects the lack of consensus as to what should be controlled. The range of comparison/control groups in this literature underscores the different research questions posed, such as whether the program produces a benefit over usual services, or whether specific program components (e.g., discussion groups to augment computer-based exercises) are critical to producing desired effects. Neither of the meta-analyses found significant differences in cognitive effect sizes between studies using an “active” control (e.g., received computer training or computer games) or a “passive” control group (e.g., watched videos or treatment as usual) (McGurk, Twamley et al., 2007; Wykes et al., 2011).

There is also significant heterogeneity across CE studies in approaches to improving cognitive functioning, including drill and practice, strategy coaching, and teaching compensatory strategies. The role and importance of teaching compensatory strategies is especially unclear. While research on CE programs for people with traumatic brain injury suggests that teaching such strategies may improve both cognitive functioning and psychosocial adjustment (Cicerone et al., 2011), we know less about the extent to which the incorporation of such strategies may be critical to the success of CE interventions for people with serious mental illnesses.

Further, there are methodological issues to consider in studies that evaluated the effects of combining CE with psychiatric rehabilitation that make it unclear whether the addition of CE is responsible for the improved outcomes. First, by intention, the integration of CE into a preexisting rehabilitation program is designed to modify those rehabilitation services. For example, in the TSW program the cognitive specialist serves as the key person responsible for integrating CE with vocational rehabilitation, with expected modifications in the vocational program from usual practice (McGurk et al., 2005). In addition to providing CE using a variety of methods (e.g., drill-and-practice exercises, strategy coaching, teaching compensatory strategies), the cognitive specialist serves as a member of the vocational team, and collaborates with other team members on tasks such as planning the job search, identifying supports and skills for promoting job retention, and facilitating the ability of vocational counselors to help clients implement coping strategies for managing cognitive challenges in work-related situations (McGurk & Mueser, 2006). While the cognitive specialist’s role in TSW focuses on CE, the aspects of their involvement that could be classified as psychosocial rehabilitation could be essential to improved outcomes (e.g., additional input/intervention for particularly challenging individuals).

Second, CE and psychiatric rehabilitation are inextricably linked in some programs, which means that when such a service outperforms psychosocial rehabilitation alone, one cannot determine the extent to which the additional gains are attributable to the combination of CE and the additional psychiatric rehabilitation or either component alone. For example, Cognitive Enhancement Therapy (CET; Hogarty et al., 2004) was developed based on many of the principles and procedures of comprehensive, holistic interventions for traumatic brain injury as previously described (Ben-Yishay et al., 1985) and earlier integrated programs for schizophrenia (Brenner et al., 1994). CET includes a broad range of program elements, including individual and small group-based computer-assisted cognitive training, group sessions providing psychoeducation on different topics, and the practice of cognitive, social-cognition, and social skills. While two studies have been conducted comparing CET to rehabilitation programs that did not include CE (Hogarty et al., 2004; Eack et al., 2009), the rehabilitation provided in the programs being compared clearly differed. Thus, the results of studies comparing CE and psychiatric rehabilitation to rehabilitation alone suggest that the combination of both approaches may be beneficial, leaving unclear whether simply
Table 1
Characteristics of Cognitive Enhancement Programs That Also Provided Psychiatric Rehabilitation From Wykes et al. (2011) Meta-Analysis

<table>
<thead>
<tr>
<th>Cognitive enhancement program</th>
<th>Psychiatric rehabilitation program</th>
<th>Studies</th>
<th>Subject populations studied</th>
<th>Timing of cognitive enhancement and psychosocial rehabilitation</th>
<th>Functional outcomes/ follow-up period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated psychological therapy. Cognitive subprograms: 26 hours over 96 weeks of drill &amp; practice, strategy coaching</td>
<td>Social skills training based on UCLA program</td>
<td>Spaulding, Reed et al. (1999)</td>
<td>Inpatients</td>
<td>Parallel</td>
<td>Social functioning over 12 months</td>
</tr>
<tr>
<td>Neurocognitive enhancement therapy: 36–126 hours of computerized drill &amp; practice (Odie Bracie) over 26–52 weeks, and weekly social and work processing groups</td>
<td>Inpatient compensated work therapy</td>
<td>Bell et al. (2001, 2005)</td>
<td>Unemployed VA patients</td>
<td>Parallel</td>
<td>Paid work in VA over 1 year; Subsidized and competitive work over 2 years</td>
</tr>
<tr>
<td>Cognitive enhancement therapy: 60–75 hours of drill &amp; practice plus strategy coaching over 104 weeks; 45 groups (1.5 hrs each) of social cognitive and social skills group sessions</td>
<td>Outpatient vocational rehabilitation</td>
<td>Bell et al. (2007, 2008) Greig et al. (2007)</td>
<td>Outpatients</td>
<td></td>
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</tr>
<tr>
<td>Cognitive enhancement program: 24 hours over 8 weeks of teaching coping strategies, computerized drill &amp; practice (COGPACK), and environmental modifications in simulated work environments</td>
<td>Control: Personal therapy</td>
<td>Hogarty et al. (2004)</td>
<td>Outpatients</td>
<td>Staged: Computerized cognitive practice followed by small group CE, and then social cognitive and social skills training</td>
<td>Psychosocial functioning over 2 years</td>
</tr>
<tr>
<td>The thinking skills for work program: 24 hours of computerized drill &amp; practice (COGPACK) with strategy coaching over 12 weeks; collaboration of cognitive and employment specialists regarding the use of compensatory strategies during job search and job performance</td>
<td>Control: Enriched supportive therapy</td>
<td>Eack et al. (2009)</td>
<td>Outpatients with early course schizophrenia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attention training: 18–24 hours over 6–17 weeks shaping attention to skills training content through active practice in social skills training groups</td>
<td>Vocational rehabilitation</td>
<td>Vauth et al. (2005)</td>
<td>Inpatients</td>
<td>Sequential: cognitive remediation program followed by vocational rehabilitation</td>
<td>All paid work over 2 years</td>
</tr>
<tr>
<td>The thinking skills for work program: 24 hours of computerized drill &amp; practice (COGPACK) with strategy coaching over 12 weeks; collaboration of cognitive and employment specialists regarding the use of compensatory strategies during job search and job performance</td>
<td>Inpatient worker program</td>
<td>Lindenmeyer et al. (2008)</td>
<td>Inpatients</td>
<td>Parallel</td>
<td>Paid work over 1 year</td>
</tr>
<tr>
<td>Supported employment</td>
<td>McGurk et al. (2005; McGurk, Mueser et al. 2007)/</td>
<td>Unemployed outpatients</td>
<td></td>
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<td>Competitive work over 2–3 years</td>
</tr>
<tr>
<td>Internship-based vocational rehabilitation</td>
<td>McGurk et al., (2009)</td>
<td>Unemployed outpatients</td>
<td></td>
<td></td>
<td>Paid work over 2 years</td>
</tr>
<tr>
<td>Attention training: 18–24 hours over 6–17 weeks shaping attention to skills training content through active practice in social skills training groups</td>
<td>Social skills training based on UCLA program</td>
<td>Silverstein et al. (2005; 2009)</td>
<td>Inpatients/outpatients</td>
<td>Integrated</td>
<td>Social skills over 6 months</td>
</tr>
</tbody>
</table>
adding CE to an existing rehabilitation program is sufficient to improve psychosocial functioning.

**Funding Implications and Recommendations for Implementing Effective CE Programs**

Considering the evidence from the two previously described meta-analyses, it is reasonable for program administrators and payers to ask, “Do CE interventions result in clinically meaningful improvements in real-world functioning and, if so, which CE interventions should I pay for, and for whom?” The answer to the first question involves speculation as to the degree to which the significant effects of CE translate into meaningful real-world benefits. For studies that compared the effects of CE and psychiatric rehabilitation to rehabilitation alone, the magnitude of the effect sizes of CE, as broadly defined here, on psychosocial functioning are in the general range of the effect sizes of most other established psychiatric rehabilitation approaches, such as the impact of cognitive–behavioral therapy for psychosis on symptoms and psychosocial functioning (Kurtz & Walz, Leucht, Bäuml, Kissling, & Engel, 2001), and the impact of social skills training on psychosocial functioning (Kurtz & Mueser, 2008).

The second and third parts of the question, pertaining to which CE programs should be paid for and for whom, raises the question of the core ingredients of effective CE programs, and who the target population should be. Since CE programs aim to improve both cognitive and psychosocial functioning, we consider next the components of programs that may need to be present in order to improve both areas of functioning, for whom, and what type of program monitoring could determine whether a specific CE intervention is benefitting people in their everyday lives. When appropriate based on the research previously reviewed, we provide specific recommendations for funders related to these issues (summarized in Table 2).

**Cognitive Enhancement Methods**

Most of the CE programs for people with serious mental illnesses have employed drill-and-practice exercises. Several computer-based drill-and-practice programs have demonstrated efficacy for improving cognitive functioning in this population. Examples include the Odie Bracy software program as applied in NET (Bell, Bryson, Greig, Corcoran, & Wexler, 2001), COGPACK software as applied in the TSW (McGurk et al., 2009, 2005) and other programs (Lindemayer et al., 2008; Sartory, Zorn, Grootzinger, & Windgassen, 2005; Vauth et al., 2005), or educational software as applied in the NEAR program (Medalia et al., 2009). However, many of these programs are supplemented with strategy coaching, and some teach compensatory strategies as well. A recently published controlled study has evaluated the effects of a group-based CE program focused primarily on teaching compensatory strategies for managing cognitive difficulties using non-computer-based practice and exercises (Twamley et al., 2012). Examples of compensatory strategies included using a calendar, self-talk, note taking, and teaching a 6-step problem-solving method, which were supplemented with drill and practice of executive functions, such as a categorization task. Positive effects were reported on cognitive functioning and a performance-based measure of social competence.

Therefore, given the limited data available, we recommend that CE programs provide one or more of drill-and-practice exercises, strategy coaching, or teaching compensatory strategies. We also note that an attention-shaping procedure developed by Silverstein et al. (2005, 2009), can be integrated into the actual provision of social skills training without utilizing these three CE methods.

**Improving Psychosocial Functioning**

In both meta-analyses, CE that was provided in the context of a specific psychiatric rehabilitation program had a stronger impact on community functioning, especially work or social functioning, than CE programs that were simply added to usual services (McGurk, Twamley et al., 2007; Wykes et al., 2011). Therefore, we recommend that CE be linked to a psychiatric rehabilitation approach in order to target a clearly defined, functional goal.

The data are too scant at this point to make recommendations regarding what types of psychiatric rehabilitation CE should be linked to. However, some trends are worthy of mention. As reviewed in Table 1, CE programs that have targeted social functioning have generally been integrated into a broader program that also provides training in some combination of social cognition and social skills. Training in a broad range of social cognition skills was an explicit emphasis of CET, which also included some social skills training (Hogarty et al., 2004). In addition, both the Spauld-

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Table 2

**Recommendations to Potential Funders of CE Interventions**

| 1. | CE programs should provide one or more of drill-and-practice exercises, strategy coaching, or teaching compensatory strategies. |
| 2. | CE should be linked to a psychiatric rehabilitation approach in order to target a clearly defined, functional goal. |
| 3. | CE programs should employ a facilitator and concerted effort be made to integrate CE with psychiatric rehabilitation. |
| 4. | The primary target population for CE programs should be individuals with schizophrenia or schizoaffective disorder or people with another serious mental illness for whom there is some evidence of cognitive impairment. |
| 5. | CE interventions should be standardized in a manual. |
| 6. | The role of CE in helping people achieve specific goals needs to be documented in the treatment plan, as well as how the CE intervention will interface with other ongoing treatments. |
| 7. | There should be formal documentation of how the CE intervention will be individualized to the person, such as linking it to his or her functional goal(s). |
| 8. | The effect of the CE program on an individual’s cognitive functioning should be formally monitored to determine whether the anticipated gains are occurring. |
| 9. | Specific targeted domains of psychosocial functioning (e.g., work, social relationships, independent living skills) that are the focus of the CE and psychiatric rehabilitation interventions should be measured and monitored routinely over the course of treatment. |
ing, Reed, Sullivan, Richardson, and Weiler (1999) and Silverstein et al. (2005, 2009) studies evaluated CE when combined with the UCLA Skills for Independent Living program (Liberman, 2007), a social skills training approach that includes training in social perception, choosing appropriate responses from alternatives, and verbal, nonverbal, and paralinguistic skills. Thus, CE programs targeting social functioning would appear to be effective when combined with psychosocial programs that focus on social skills and social cognition.

There is a less consistent pattern in the CE programs that have targeted work. Among the CE programs that focused on work summarized in Table 1, one study was conducted in a supported employment program (McGurk et al., 2005; McGurk, Mueser, Feldman, Wolfe, & Pascaris, 2007), the only evidence-based practice for improving competitive work in people with SMI (Drake, Bond, & Becker, 2012). The remaining five studies evaluated other vocational rehabilitation approaches, and typically examined all paid work rather than competitive work outcomes (Bell, Bryson, Greig, Fiszdon, & Wexler, 2005; Bell, Zito, Greig, & Wexler, 2008; Lindenmayer et al., 2008; McGurk et al., 2009; Vauth et al., 2005). While these studies provide limited guidance to CE programs targeting work, combining CE with supported employment appears to have the greatest promise for improving competitive work.

An additional variable related to improving psychosocial functioning is the active participation of a facilitator (e.g., clinician) for the CE activities. All of the programs that combined CE and rehabilitation involved a facilitator, and in most studies there was an attempt to integrate the CE and rehabilitation programs (see Table 1). It remains to be seen whether providing CE without facilitation by such an individual, in addition to psychiatric rehabilitation, improves functioning more than rehabilitation alone. In the absence of such evidence, it appears premature for payers to cover CE that is limited to computer-based practice (without an active facilitator). Similarly, little is known about whether adding nonintegrated, facilitator-based CE to rehabilitation improves functional outcomes more than rehabilitation alone. Thus, based on the available research, it seems prudent to recommend that CE programs employ a facilitator and that concerted effort be given to integrating the CE component with psychiatric rehabilitation.

Duration and Intensity of Program

There are substantial differences in the intensity and duration of CE programs, with some providing over 100 hours of training, and others providing less than 20 hours. The frequency of practice sessions and duration of CE varies as well, ranging from a minimum of weekly practice to a maximum of daily practice, and training periods ranging from as little as several weeks to over a year. This raises the question of, “What defines a minimally effective program of CE?”

As with many other interventions for people with serious mental illnesses (e.g., cognitive–behavioral therapy for psychosis; Wykes et al., 2008), there is no definitive answer to this question. However, some broad parameters for program components, intensity, and duration may be drawn from studies of CE that also provided psychiatric rehabilitation included in Wykes et al. (2011), as such programs were found to have the strongest impact on functional outcomes. Inspection of the programs summarized in Table 1 indicates that four of the six programs provided 21–24 hours of training, with the other two programs providing more than twice as many hours. Three programs lasted between 8 and 12 weeks, with the remaining three programs being much longer. Finally, five out of the six programs provided more than weekly sessions, with three programs providing approximately two sessions per week. Together, these findings suggest that a CE program should provide at least 20 hours of CE over at least 10 weeks, preferably with multiple training sessions scheduled per week. It should be noted that briefer training periods have been reported in some CE programs provided to inpatients (Silverstein et al., 2005; Vauth et al., 2005).

Target Population

Most research on CE for psychiatric disorders has focused on individuals with schizophrenia, although some studies have also included people with other serious mental illnesses. As the development of schizophrenia is frequently associated with some decline in cognitive functioning, the dominant assumption in the field has been that people with cognitive impairments, most notably those with schizophrenia (or schizoaffective disorder), are the most appropriate candidates for CE. In the Wykes et al. (2011) meta-analysis, CE studies that included only participants with schizophrenia or schizoaffective disorder had significantly larger effects on improving cognitive functioning than those also including participants with other disorders. However, cognitive impairment as a study inclusion criterion was not related to improvements in cognitive or psychosocial functioning.

The relationship between baseline cognitive impairment and response to CE has been examined in some studies, with mixed findings. Fiszdon, Choi, Bryson, and Bell (2006) reported that individuals with schizophrenia who had intermediate levels of intellectual impairment benefitted more from the addition of CE to a vocational program than those with less or more severe intellectual impairment. Medalia and Richardson (2005) compared clients who demonstrated a reliable improvement in at least one area of cognitive functioning following CE to those who did not across three studies of NEAR, and found baseline neuropsychological assessments were generally not related to improvement.

Participants’ symptom severity and age have also been explored as potential moderators of the effectiveness of CE. In the Wykes et al. (2011) meta-analysis, there was a trend for greater baseline symptom severity to be associated with less improvement in cognitive functioning, suggesting that clients with less severe symptoms benefit more from CE. Although two studies have reported that older participants improve less in cognitive functioning from CE (McGurk & Mueser, 2008; Wykes et al., 2009), a third did not (Medalia & Richardson, 2005), and the average age of participants in the Wykes et al. meta-analysis was not related to cognitive change.

A cautious extrapolation from research on participant factors and response to CE yields a recommendation that the primary target population for CE be individuals with schizophrenia or schizoaffective disorder, or people with another serious mental illness for whom there is evidence of cognitive impairment. Clinically, participants whose symptoms are less severe may be expected to benefit more from CE.
Program Monitoring

The broadly accepted long-term goal of CE is to improve psychosocial functioning, and the CE research to date currently indicates that such improvements are most likely to occur when CE is combined with a specific psychiatric rehabilitation approach. From the perspective of a funder, this leads to the question of “What program monitoring should be required for CE interventions to ensure the greatest impact on functional outcomes?” We have several recommendations to address this question.

First, the CE intervention should be standardized in a manual. In addition, staff training standards and objective fidelity assessments should be established that would serve to identify significant deviations from the treatment delivery model, and the performance monitoring entity should have the ability to provide rapid feedback and ongoing monitoring to ward off slippage. Second, the role of CE in helping people achieve specific goals needs to be documented in the treatment plan, as well as how the CE intervention will interface with other ongoing treatments. Third, there is a need to document how the CE intervention will be individualized to the person, such as linking it to his or her functional goal(s). Fourth, an objective evaluation of the impact of the CE program on cognitive functioning is important, as by definition it is a critical target for CE. Relatively brief, standardized cognitive assessments can be conducted that require a minimum of training and cost, and these can be used to document whether expected gains in cognitive functioning are occurring, inform treatment of individual participants in the program, and to monitor performance of the program itself. And fifth, specific, targeted domains of psychosocial functioning (e.g., work, social relationships, independent living skills) that are the focus of the CE and psychiatric rehabilitation interventions should be routinely measured and monitored over the course of treatment.

How and by whom programs might be monitored is a question for funders, as well as what range in outcomes would be acceptable for continued funding. Many payers today understandably have concerns that a wide range of effective and ineffective interventions are being paid for in the name of “psychotherapy,” and one wants to avoid a situation where virtually anything may be called “CE” and billed for. Requiring the identification and tracking of program treatment targets, interventions, and outcomes helps protect payers and persons receiving services from such poor investments of time and resources. Clearly, intermediate steps will be needed in the transition from the current status of services to an embedded system for tracking targets, interventions, and outcomes.

From a funder’s perspective, one wants to pay for effective treatment. At this point in time, the data support the conclusion that CE programs that include a facilitator and are implemented in the treatment plan, as well as how the CE intervention will be standardized in a manual. In addition, staff training standards and objective fidelity assessments should be established that would serve to identify significant deviations from the treatment delivery model, and the performance monitoring entity should have the ability to provide rapid feedback and ongoing monitoring to ward off slippage. Second, the role of CE in helping people achieve specific goals needs to be documented in the treatment plan, as well as how the CE intervention will interface with other ongoing treatments. Third, there is a need to document how the CE intervention will be individualized to the person, such as linking it to his or her functional goal(s). Fourth, an objective evaluation of the impact of the CE program on cognitive functioning is important, as by definition it is a critical target for CE. Relatively brief, standardized cognitive assessments can be conducted that require a minimum of training and cost, and these can be used to document whether expected gains in cognitive functioning are occurring, inform treatment of individual participants in the program, and to monitor performance of the program itself. And fifth, specific, targeted domains of psychosocial functioning (e.g., work, social relationships, independent living skills) that are the focus of the CE and psychiatric rehabilitation interventions should be routinely measured and monitored over the course of treatment.

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From a funder’s perspective, one wants to pay for effective treatment. At this point in time, the data support the conclusion that CE programs that include a facilitator and are implemented in combination with specific, well-defined psychiatric rehabilitation programs can improve psychosocial outcomes. Several open policy questions remain: How minimal can the CE addition be and still be effective, and what psychosocial rehabilitation platforms are sufficient? How should the quality and extent of psychosocial rehabilitation services be assessed before the funder agrees to pay for the implementation of CE services?

Future Directions for Clinical Research

The synthesis of research on CE, and recommendations to potential funders of CE services, suggest several avenues for future research. Fundamental to all research in this area is the use of improved technology for measuring functional outcomes, including distinctions between capacity-based performance measures (e.g., Social Skills Performance Assessment; Patterson, Moscona, McKibbin, Davidson, & Jeste, 2001) versus clinician- or other-rated scales (e.g., Quality of Life Scale; Heinrichs, Hanlon, & Carpenter, 1984) versus subjective life satisfaction measures (e.g., Quality of Life Enjoyment and Satisfaction Questionnaire; Ritsner, Kurs, Gibel, Yael Ratner, & Endiccott, 2005). Broadly speaking, the field must continue to evaluate the circumstances under which CE can impact real-world functioning for people with SMI. This includes examining which CE interventions (and components therein) are most effective when combined with which psychosocial rehabilitation programs (when distinct from CE) and who is most likely to benefit (Wykes & Spaulding, 2011). Research aimed at understanding how and why CE works would also benefit the field.

Research is needed to disaggregate the bundle of treatment components included in CE programs in order to determine their relative utility for improving cognitive and functional outcomes and to determine the significance, if any, of components that differ across programs. Identifying whether such program components are effective but interchangeable could provide program administrators with important options. Critical components that may deserve consideration include strategy coaching to improve performance on cognitive exercises, teaching compensatory strategies for cognitive difficulties, training in metacognition, enhancement of sensory processing in addition to exercises focused on higher cognitive functions, computer-based exercises plus the selection of associated software, and methods for combining CE with other rehabilitation services.

Social cognition is an important predictor of psychosocial adjustment (Couture, Penn, & Roberts, 2006; Penn, Corrigan, Bennett, Racenstein, & Newman, 1997), and may partly mediate the relationship between cognitive impairment and social functioning (Fett et al., 2011; Hoe, Nakagami, Green, & Brekke, 2012) and rehabilitation outcome (Bell et al., 2009). An emerging body of research focuses on training in social cognition (Kurtz & Richard- son, 2012; Roberts & Velligan, 2012; Statucka & Walder, 2013). Furthermore, training in social cognition (and social skills) is integrated into comprehensive CE programs focusing on social functioning such as CET (Hogarty et al., 2004) and IPT (Brener et al., 1994), and one recent study reported that adding social cognition training to CE led to greater improvements in social functioning than CE alone (Lindenmayer et al., 2013). As noted earlier (in the section on Definition of Cognitive Enhancement), there was debate among the panel members as to whether social cognition should be included as a target of CE and, at a more fundamental level, whether social cognition should be viewed as a component of cognition, in the way that the latter term has traditionally been defined. However, there was agreement that social cognition was an important target for treatment (whether construed as CE or psychiatric rehabilitation). There is clearly a need for more research on the role of social cognition training, in combination with CE and/or psychiatric rehabilitation, in improving...
psychosocial outcomes. Aside from evaluating the effects of adding social cognition training to CE and/or psychiatric rehabilitation, many other questions could be addressed, such as: What domains of social cognition are most important to target? Are some domains of social cognition more critical to some types of psychosocial functioning than other domains? How should training in social cognition be integrated into the CE and psychiatric rehabilitation components of treatment?

The field also needs research to examine more closely the characteristics of psychiatric rehabilitation programs most critical to improving psychosocial functioning when combined with CE. Similarly, with respect to efforts to improve vocational outcomes, as previously discussed (in the section on Improving Psychosocial Outcomes), more research is needed on combining CE with supported employment, an evidence-based practice for improving competitive work outcomes for people with serious mental illnesses (Drake et al., 2012).

A related topic is the potential impact of CE on improving the effectiveness of supported education programs for this population. The early onset of schizophrenia often curtails educational attainment (Kessler, Foster, Saunders, & Stang, 1995), contributing to worse employment outcomes (Mueser, Salyers, & Mueser, 2001). Recent efforts to integrate supported education into supported employment programs for individuals recovering from a first episode of psychosis have shown promising effects (Killackey, Jackson, & McGorry, 2008; Nuechterlein et al., 2008), but there is still a lack of evidence for the effects of these types of programs on helping people achieve important educational milestones and establish rewarding careers (Mueser & Cook, 2012). The addition of CE to supported education, as described in a recent pilot study (Kidd, Bajwa, McKenzie, Ganguli, & Khamneh, 2012), could result in a greater impact on educational outcomes and long-term employment in this population.

More research is needed to evaluate whether participant characteristics can be identified that predict benefit from CE. Currently, there is a lack of evidence concerning whether people with diagnoses other than schizophrenia benefit from CE and whether any benefit such individuals derive is dependent upon them having impaired cognitive functioning. While some evidence suggests that stabilizing psychiatric symptoms prior to CE may facilitate benefit (Wykes et al., 2011), greater attention to individual nonclinical factors may be more productive, such as motivation (Medalia & Richardson, 2005; Medalia & Saperstein, 2011) and self-esteem and self-efficacy (Wykes & Spaulding, 2011). An additional issue is that change in CE does not occur in a vacuum, but rather usually in the context of a therapeutic relationship, suggesting that the measurement of treatment characteristics such as the working alliance may be important (Wykes & Spaulding, 2011).

Some related questions are whether people with certain types of functional impairments are more likely to benefit from particular approaches to CE and whether such individuals should first be engaged in rehabilitation services targeting those impairments before providing CE. There is no empirical guidance for these issues. Some comprehensive CE-rehabilitation programs are offered to all individuals with impaired functioning in specific areas, such as social functioning (e.g., Hogarty et al., 2004). Other CE programs have been offered to individuals enrolling in (or already enrolled in) a particular psychosocial program, such as vocational rehabilitation (Bell et al., 2008; Lindenmeyer et al., 2008; McGurk et al., 2009; Vauth et al., 2005), or have focused on those who have experienced past failures in achieving a rehabilitation goal, such as employment (McGurk et al., 2005).

Finally, further research is needed to evaluate the mechanisms underlying the beneficial effects of CE interventions. An improved understanding of how CE works could lead to refinements in CE interventions that permit more efficient and streamlined programs, individual tailoring, and specific targeting of nonresponders. Numerous theories have been advanced regarding how CE may improve cognitive and psychosocial functioning (Brenner et al., 1994; Fisher et al., 2013; Hogarty et al., 2004; Wykes & Spaulding, 2011). The theories address different, but overlapping, levels of analysis, such as biological (e.g., brain plasticity), cognitive (e.g., efficient processing of social contextual information), psychological (e.g., motivation), and environmental processes (e.g., learning opportunities). While it is beyond the scope of this paper to review specific theories and recommend next steps, this, too, is an area for further development.

Conclusions

CE is a rapidly growing field of treatment for persons with serious mental illnesses. As with all interventions, there is the associated risk that the marketing of CE may exceed the evidence base, and the purchasers of such services need to be mindful of the old adage caveat emptor (Mueser & Herbert, 1993). CE programs vary widely in the methods and personnel used to improve cognitive functioning, their intensity and duration, and their relationship to other psychiatric rehabilitation programs (e.g., none, parallel, integrated, comprehensive, and integrated). While the extent to which CE interventions contribute to improved psychosocial functioning remains unclear, mounting evidence does suggest beneficial effects for CE, broadly defined, especially when it is combined with specific psychiatric rehabilitation.

As with any new and evolving treatment approach, considerable debate continues about how to interpret research results, the implications for clinical practice, and the relative merits of investing program resources in CE interventions versus other treatments or services. The discussion among the panel of experts assembled by NYSOMH in 2008 was a microcosm of the ongoing debate about CE in the broader scientific community. This debate has continued unabated in the 5 years since the meeting, as reflected by the contrasting conclusions of the latest meta-analysis (that broadly defined CE interventions when imbedded in psychosocial rehabilitation programs are effective in improving functional outcomes) and the most recent treatment PORT guidelines for schizophrenia (where CE was not among the interventions endorsed as effective; Dixon et al., 2010). While it is easy to highlight the differences of opinion among panel members, there was a consensus that significant progress has been made in the development of an intervention approach that targets one of the most stubborn and disabling features of many mental illnesses—cognitive impairment.

There was a unanimous call among the experts for more research on the effectiveness of CE for people with serious mental illnesses. There was diversity of opinion about the next steps to be taken regarding the funding of CE interventions. This included the questions of whether and under what circumstances CE interventions should be funded as a treatment, how the performance of such programs should be monitored, and which individuals might
be expected to benefit from CE as evidenced by improved functioning in their everyday lives.

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