Cognitive Remediation Services for People with Schizophrenia: Considerations for Health Service Practitioners

Anthony O. Ahmed, Marie C. Hansen, & Jean-Pierre Lindenmayer

Cognitive deficits are a prominent feature of many psychiatric disorders and are predictors of decreased functioning, quality of life, and treatment response. Cognitive remediation focuses on improving cognitive skills through repeated practice and strategy learning. In people with schizophrenia, cognitive remediation is associated with improvements in cognition and psychosocial functions. This article provides an overview of cognitive remediation and some considerations for developing a cognitive remediation service in a treatment setting.

You have been serving as a psychologist for a couple of years now in a program that treats people with severe mental illness. The program operates both a general mental health unit and a forensic unit. It is clear to you that the cognitive difficulties clients manifest affect their overall functioning and responsiveness to treatment. Nurses have observed that some clients require repeated reminders to take medications or attend unit activities. Staff on the forensic unit have reported that some clients have difficulty sustaining attention and generalizing concepts learned during court-mandated skills training and rehabilitation. You have observed in your work with violent offenders that many have deficits in correctly judging the emotions and intentions of others. You have been wondering whether there is a program you could implement across all units to target the myriad of cognitive deficits and their functional effect on individuals served in the program.

Cognitive deficits are a feature of several psychiatric and neurological disorders, such as psychotic disorders, major mood disorders, and alcohol and substance use disorders (Trivedi, 2006). These include deficits in general intellectual capacity and/or specific cognitive abilities that persist independently of illness state. In many syndromes, cognitive deficits contribute to significant disability, decreased quality of life, and decreased treatment response (Jabben, Arts, van Os, & Krabbendam, 2010). The last two decades have seen an increase in the number of studies evaluating the benefits of interventions for cognitive deficits, suggesting an increased attention to the impact of cognitive deficits and the prospects of treatment (van Passel et al., 2016). The current article focuses on one such evidence-based treatment for cognitive deficits—cognitive remediation training—with a focus on its dissemination in schizophrenia.

What is Cognitive Remediation?

Cognitive remediation is a behavioral intervention focused on improving "thinking capacity or skills" through repeated training, and teaching transferable cognitive strategies while enhancing motivation and metacognitive awareness (Medalia & Choi, 2009). The general targets for training are intellectual functioning and/or areas of specific deficit, such as attention, memory, processing speed, and reasoning/problem-solving (Sablier, Stip, & Franck, 2009). Cognitive remediation capitalizes on several principles drawn from learning theory and behaviorism to support the acquisition and performance of skills. These include errorless learning, hierarchical scaffolding, prompting, shaping and positive reinforcement, modeling, and anchoring and generalizing (See Table 1).

Current cognitive remediation programs use computer software to present cognitive tasks that progressively increase in difficulty as the client repeatedly trains and gains mastery. This "drill-and-practice" approach assumes that repeated practice and gradual scaffolding will contribute to neuroplasticity-based neural reorganization. A goal of cognitive remediation programs is to gen-

Dr. Anthony Ahmed is an Assistant Professor in the Department of Psychiatry at Weill Cornell Medicine. He completed his doctoral training in clinical psychology at the University of Southern Mississippi, a psychology internship at the VA Maryland Health Care System/ University of Maryland Baltimore. Dr. Ahmed completed a Psychotic Disorders Postdoctoral Fellowship at the Medical College of Georgia in Augusta University. Dr. Ahmed serves as attending psychologist for the Psychotic Disorders Division at NewYork Presbyterian Hospital. He conducts clinical and translational research in people with schizophrenia.

Marie Hansen is a fourth-year PhD candidate in Clinical Psychology at Long Island University Brooklyn and a Recovery Coach at Columbia University's Lieber Recovery Clinic. She received her Masters Degree in Clinical Psychology from Teachers College, Columbia University in 2014. Her research interests include cognitive remediation, peer support, and integrative therapies for distressing psychosis.

Dr. Jean-Pierre Lindenmayer is Director of the Psychopharmacology Research Program at Manhattan Psychiatric Center - Nathan Kline Institute for Psychiatric Research, Clinical Director of the Manhattan Psychiatric Center, and Clinical Professor, Department of Psychiatry at New York University School of Medicine. Dr. Lindenmayer's interest in research has included the development of new pharmacological and neurocognitive treatments for schizophrenia patients.

eralize cognitive skills into several aspects of community living to improve functioning in those areas (Medalia & Choi, 2009). This is mostly accomplished through *bridging groups*. Bridging groups provide a setting for explicit discussions of the relevance of cognitive skills to independent living, community activities, life goals, and valued social roles. Bridging groups also aim to facilitate metacognitive awareness of clients' own cognitive style, strengths, and preferences and how increased cognitive awareness aids better community functioning. Led by one or two group leaders, bridging groups are typically held following computer-aided drill-and-practice sessions. Group leaders use Socratic questioning to elicit group members' prior knowledge of cognitive functions, and use in-session demonstrations to illustrate cognitive strategies to promote the acquisition of new skills.

Cognitive assessments provide critical information about broad or more specific areas of cognitive impairment that illuminate the etiology of the client's disability and indicate important targets for treatment. Baseline assessments can help plan the configuration or strategy for cognitive remediation. The principle of neuroplasticity provides a mechanism by which cognitive remediation contributes to improved cognitive functions. Neuroplasticity is a fundamental attribute of the nervous system, referring to its neurostructural and neurofunctional malleability in response to injury, environmental inputs, and learning (Kolb & Teskey, 2012). Imaging studies have shown that cognitive remediation contributes to structural and functional improvements in brain regions relevant to cognitive functions (Ramsay & MacDonald, 2015).

Cognitive Remediation for Schizophrenia Spectrum Disorders

Cognitive Deficits in Schizophrenia

Cognitive deficits have been recognized as a central feature of schizophrenia spectrum disorders since Kraepelin and Bleuler's early conceptions (Green & Harvey, 2014). These deficits are present in about 70–85% of schizophrenia clients (Kremen et al., 2000). Cognitive deficits contribute to difficulties with remembering to take medications, limited insight into illness, treatment disengagement, and difficulty retaining skills learned in psychosocial treatment groups.

Relative to control samples, people with schizophrenia show reduced scores on cognitive assessments, often scoring between one and two standard deviations below the general population (Kern et al., 2011). Cognitive deficits are independent of the acuity of psychotic symptoms and are present regardless of the stage of illness. The alterations in cognitive functions include deficits in general intellectual ability and specific cognitive domains, such as memory, attention, processing speed, verbal and visual learning, executive functions, and social cognition. Neuroimaging studies point to broad and ubiquitous structural and functional abnormalities that better support the presence of a global impairment (Zhuo et al., 2017).

Assessing Cognition in Schizophrenia

It is apparent that the assessment of cognitive deficits and the identification of targets for cognitive remediation should have several objectives. First, cognitive evaluations should aim to index the severity of global cognitive impairment given that reduced general intellectual ability is a hallmark of schizophrenia. Additional assessment of the individual's premorbid intellectual ability before illness onset can inform about the degree of global decline. Cognitive assessments should also seek to index domain-specific impairments that often co-exist with global decline. Social cognition abnormalities found to be most germane to schizophrenia are in facial emotion recognition, social perception, theory of mind/mentalizing, and attributional biases (Mancuso, Horan, Kern, & Green, 2011). Studies show that social cognitive impairments are even stronger predictors than basic cognitive deficits of impaired social functioning in schizophrenia (Horton & Silverstein, 2008); we recommend an assessment of these abilities.

Table 1. *Cognitive Remediation Learning Principles*

Principle	Notes
Errorless Learning	• Slow and gradual increase or decrease of the difficulty level of behavioral tasks to minimize errors in learning or the use of trial and error. • Decreases the challenge of cognitive tasks in order to maximize the client's success so that the client can remember the strategies associated with success.
Hierarchical Scaffolding	• Goal of task scaffolding is to ensure that the client is engaged in effortful learning in the absence of frustration due to failure, or boredom in the absence of challenge. • Ensures that tasks challenge the client but remain within the client's range of competence. • As the client's competence is improved through learning, the demand task is slowly adapted to the client's new level of competence. • Built into the training activities such that training begins with simple tasks and progressively incorporates more challenging and complex tasks.
Coaching	• Coach monitors the client's performance and responds to client's needs during remediation sessions. • Coaching may involve verbal prompting to aid "guided discovery" of the correct response. • Verbal prompts may be in the form of open-ended Socratic questioning.
Modeling	• Coach demonstrates a specific behavior relevant to completing a cognitive task such as how to visually track multiple objects during a divided-attention task. • Modeling could also be used to demonstrate a strategy learning skill (e.g., using repetition to remember names at a party).
Shaping and Positive Reinforcement	• Use of praise or positive feedback to shape behaviors that reflect the use of thinking skills such as staying on task (sustained attention), punctuality (requires memory, planning, and organizing skills), correct responses during a task, etc. • Use of primary reinforcers (e.g., food, drinks, incentives) to reinforce attendance and engagement in cognitive remediation.
Anchoring and Generalizing	• Linkage or generalization of cognitive skills into contexts outside of the training environment. • Accomplished through explicit bridging group discussion.
Drill-and-Practice	• Repeatedly training on the same task that progressively increases in difficulty with mastery. • Often computer software-assisted. • Drawback is that the repetitive nature of training on the same task may increase risk of boredom. • Dynamic task presentation such as training on a different version of the same activity may attenuate boredom.
Strategy Learning	• Underscores the acquisition of efficient ways of completing cognitive tasks that can be generalized to challenges in daily living. • Strategies that are learned are practiced repeatedly. • Application to situations germane to the client's functioning are underscored.

In cognitive remediation clinical trials, the assessment of cognitive domains has become part of the norm. The NIMH-funded Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS; [Green et al., 2004]) research team reviewed the most widely used measures of cognitive functioning in schizophrenia research. These measures were evaluated based on their psychometric properties—and 10 cognitive tasks that assess seven domains were selected for inclusion in the MATRICS Consensus Cognitive Battery (MCCB) for schizophrenia (Kern et al., 2008) (see Table 2). The MCCB includes the Myer-Salovey-Caruso Emotional Intelligence Test (MSCEIT) as its measure of social cognition. Another battery is the Brief Assessment of Cognition in Schizophrenia (BASC; [Keefe et al., 2008]). Table 2 includes a list of relevant cognitive abilities and some measures that have been used to assess them in schizophrenia. With training and supervision, these cognitive assessments can be reliably administered by graduate-level practitioners. Norms for the MCCB and the BACS are available in technical manuals that accompany the complete testing kits.

Other Outcomes of Interest.

Measures such as the Positive and Negative Syndrome Scale (PANSS), Brief Psychiatric Rating Scale (BPRS), and Symptom Checklist-90 (SCL-90) provide information about the severity of psychosis and other associated symptoms in schizophrenia. It is also useful to evaluate domains of psychosocial functioning that may be affected by cognitive deficits. Measures of functional capacity, such as the UCSD Performance-Based Skills Assessment (UPSA) and the Independent Living Scales (ILS)—and measures of functional performance, such as the social functioning scale (SFS)—are routinely administered in treatment studies of cognition.

Cognitive Remediation Effects in Schizophrenia

A vast literature on the benefits of cognitive remediation for people with schizophrenia has accumulated over the last four decades. There are more than 50 published studies of cognitive remediation for people with schizophrenia. Most studies involve modalities that directly target higher level cognitive functions. Others focus on the training of basic sensory processing functions and assume that through neuroplasticity, these subsequently translate to improved higher order cognitive functions (Keshavan, Vinogradov, Rumsey, Sherrill, & Wagner, 2014). In addition, cognitive remediation has been implemented as either a standalone intervention, or in combination with other psychosocial interventions (Bowie, McGurk, Mausbach, Patterson, & Harvey, 2012).

Most cognitive remediation studies demonstrate that cognitive remediation leads to improvements in cognitive functioning. The most recent meta-analytic review of 40 studies of cognitive remediation in people with schizophrenia obtained an average medium effect size (Cohen's d = 0.448) on global cognition (Wykes et al., 2011). Across specific cognitive domains, the smallest effects were seen for visual learning and memory (d = 0.15), whereas the largest effects were obtained for reasoning/problem-solving (d = 0.572) and social cognition (d = 0.651). The meta-analysis also found that cognitive remediation contributed small effects to symptom improvements (d = 0.177) and small to medium effects in psychosocial functioning (d = 0.418). All of the effects were generally maintained at follow-up assessments but effects on symptoms lost statistical significance.

The meta-analysis showed that cognitive remediation effects did not depend on the configuration of cognitive remediation (i.e., independent of modality of cognitive training such as dosage or duration of training, or the use of paper–pencil versus computers). The average duration of cognitive training was 32.2 hours (range = 4–130) provided over 16.7 weeks (range = 2–140) at 2.2 sessions per week (range = 0.6–5). The specificity of cognitive remediation—that is, whether remediation was geared toward specific cognitive domains of concern to the participant or whether remediation was general—appeared to make little difference on cognitive remediation outcomes in schizophrenia. Cognitive remediation was more effective when participants were symptomatically stable. Study effect sizes were in the "large" range when cognitive remediation was provided in combination with other psychosocial interventions.

Another meta-analysis focused on 19 studies that targeted the specific remediation of social cognitive abilities (Kurtz & Richardson, 2011). The study obtained medium effects on theory of mind (d = 0.49) and large effects on facial affect recognition (d = 0.71) and discrimination (d = 1.01). In contrast, effects on social perception (d = 0.13), aggression (d = 0.25), hostility (d = 0.15), and attribution bias were in the minimal to small range. Remarkably, the effects of remediating social cognition deficits on symptoms (d = 0.68) and community functioning (d = 0.78) far exceeded those obtained from remediating basic cognitive skills. Specific effects on positive (d = 0.26) and negative (d = 0.15) symptoms were not statistically significant. Treatment effects were best for individuals with a longer duration of illness. The average dose of training was about 23 hours (range = 1–93) provided over 1 to 62 weeks. A dose-response effect was apparent with longer treatments producing greater improvements on social cognition measures. It is currently unclear if remediating one domain of social cognition translates to other social cognition domains. It is possible that training one social cognition domain may translate to basic neurocognitive functions. For example, exercises that remediate affect recognition may serendipitously train visual attention given that the latter is required to carry out the former.

Some studies have investigated moderators of cognitive remediation effects including individual client variables. There is

Table 2. *Assessing Cognitive Targets for Remediation in Schizophrenia*

	Domain	Assessment Measure
Neurocognitive Functioning	Processing Speed	BACS: Symbol Coding (MCCB) Category Fluency (MCCB) Trail Making Test (MCCB) Coding (WAIS-IV; RBANS) Symbol Search (WAIS-IV) Cancellation (WAIS-IV)
	Sustained Attention	CPT (MCCB) Cancellation Tasks (e.g., WAIS-IV)
	Working Memory	WMS-III: Spatial Span (MCCB) Letter-Number Sequencing (MCCB; WAIS-IV) Digit Span (WAIS-IV) Arithmetic (WAIS-IV)
	Verbal Learning	HVLT-R (MCCB) California Verbal Learning Test (CVLT) Rey Auditory Verbal Learning Test (RAVLT) Story Memory (RBANS) List Learning (RBANS)
	Visual Learning	BVMT-R (MCCB) Rey–Osterrieth Complex Figure Test (ROCF)
	Problem-Solving	NAB-Mazes (MCCB) Tower of Hanoi Task Wisconsin Card Sorting Test
Social-Cognitive Functioning	Facial/Bodily Emotion Perception	Bell-Lysaker Emotion Recognition Task (BLERT) Penn Emotion Recognition Test
	Social Perception	Relationships Across Domains (RAD) The Awareness of Social Inferences Test (TASIT) The Hinting Task
	Theory of Mind	Reading the Mind in the Eyes Task (Eyes) Trustworthiness Task
	Attributional Style	Ambiguous Intentions Hostility Questionnaire (AIHQ) Internal, Personal, Situational Attributions Questionnaire (IPSAQ) Leeds Attributional Coding System (LACS)
	Emotional Intelligence	MSCEIT (MCCB)
General Intelligence	Verbal Comprehension	Vocabulary, Similarities (WAIS-IV; WASI-II)
	Perceptual Reasoning	Block Design, Matrix Reasoning (WAIS-IV; WASI-II) Visual Puzzles Picture Completion, Figure Weights (WAIS-IV)
	Pre-Morbid Intelligence	Wechsler Test of Adult Reading (WTAR) National Adult Reading Test (NART) Wide Range Achievement Test-3 Reading Subtest (WRAT-3)

Note. BVMT-R = Brief Visuospatial Memory Test—Revised; CPT = Continuous Performance Test; HVLT-R = Hopkins Verbal Learning Test—Revised; MCCB = MATRICS Consensus Cognitive Battery; MSCEIT = Mayer-Salovey-Caruso Emotional Intelligence Test; WAIS-IV = Wechsler Adult Intelligence Scale—Fourth Edition; WASI-II = Wechsler Abbreviated Scale of Intelligence—Second Edition; WMS-III = Wechsler Memory Scale—Third Edition.

evidence that client factors such as younger age, higher IQ, and less disorganization were associated with greater gains from cognitive remediation (Wykes et al., 2011). Higher antipsychotic dosing was associated with lesser gains perhaps due to an accumulation of antipsychotic-induced anticholinergic cognitive burden (Vinogradov, Fisher, Warm, et al., 2009). Lower intrinsic motivation is another factor with implications for cognitive remediation. Clients with lower motivation for treatment show decreased gain from cognitive remediation (Medalia & Richardson, 2005). This is an important variable, as impaired motivation is a common feature of schizophrenia (Strauss, Whearty, Frost, & Carpenter, 2016) and a factor that is able to be tailored for treatment (Medalia, Saperstein, Hansen, & Lee, 2016).

Starting a Cognitive Remediation Service in a Clinical Program

Cognitive remediation platforms can be incorporated in clinical programs as part of regularly provided services. Several cognitive remediation programs have already been incorporated into treatment services in inpatient and outpatient settings (see Table 3). Cognitive remediation, of course, can be set up in other clinical settings such as outpatient, acute, longer term, correctional, educational, rehabilitative, forensic services, and even private practice (Medalia et al., 2009). The information provided here can be extrapolated to such settings.

Step 1—Identify the Setting of the Cognitive Remediation Service

Cognitive remediation has mostly been implemented in outpatient and hospital settings providing services for general mental healthcare recipients. The practitioner may choose to target cognitive remediation services to specific diagnostic groups. Alternatively, the goal of the cognitive remediation service could be the enhancement of specific treatment objectives to address treatment program needs, pressures, or mandates. Forensic settings and correctional facilities provide opportunities for practitioners in such settings to open new frontiers for cognitive remediation services (Ahmed et al., 2015; Ahmed, Hunter, van Houten, Monroe, & Bhat, 2014).

The tenure of prospective participants in the treatment setting might affect the feasibility of a cognitive remediation service. It may be challenging to meet the minimum therapeutic dose of cognitive remediation in hospital units with a very short length of stay. In such context, the clinician may consider a higher frequency of cognitive remediation sessions per week in order to achieve enough dosing hours before discharge. Whereas a frequency of 2–3 remediation sessions weekly might suffice for an intermediate to long length of stay treatment unit or for an extended outpatient treatment service, clinicians should consider providing 4–5 sessions weekly for short-term programs.

Although age and illness duration moderates gains from cognitive remediation, the intervention should be made available to all clients. Age-related cognitive declines add to schizophrenia-related cognitive deficits, further necessitating the need for remediation. We have found that older clients are often less technologically savvy than younger clients and may require additional support to enhance their familiarity with computer hardware and the software library.

Step 2—Define the Objective of the Cognitive Remediation Service

Our group has been involved in the development of cognitive remediation services in state hospitals, forensic settings, intermediate length of stay facilities, and partial hospital programs. In each setting, we have endeavored to tailor cognitive remediation services to each setting's program goals. We found that hospital or program administrators favor proposals to begin a cognitive remediation service when administrators viewed the service as consistent with the program's mission and deliverables.

Articulating the confluence of the service to program goals may also aid in the identification of deliverables that would be viewed favorably by stake holders. Given that computer-based activities typically used for cognitive remediation mimic generic computer games, we recently justified the consideration of cognitive remediation as part of recreational activities. Cognitive deficits contribute to a limited ability to recall past pleasurable experiences, prospectively plan for future pleasure, and subsequent apathy in the pursuit of potentially pleasurable situations (Strauss & Gold, 2012). Bridging groups focus on extrapolating the consummatory pleasure experienced within the session and applying it to planning, scheduling, and strategizing for future pleasurable activities.

The current shift of healthcare systems toward integrated delivery provides an opportunity for clinicians to target cognitive remediation services and treatment objectives in a way that promotes confluence and continuity with treatment provided by other disciplines. General medical conditions that contribute to cognitive impairments—such as traumatic brain injury, dementia, epilepsy, multiple sclerosis, and psychiatric disorders characterized by a myriad of medical problems (e.g., schizophrenia)—necessitate multidisciplinary care. In this vein, cognitive remediation services should be considered for inclusion in primary care, neurosurgical, physical rehabilitation, neuro-trauma, geriatric, and homecare settings.

Step 3—Take Inventory of Existing and Needed Resources

Computer hardware, physical space, staff, software, file cabinets, and finances—among others—are considered "needed resources." It is helpful to begin by working with the hospital

Table 3. *Models of Cognitive Remediation in Schizophrenia*

Program Name	Format	Materials	Length	Notes
Integrated Psychological Treatment (IPT) Roder, Mueller, Mueser, Brenner (2006)	Group	Group Exercises	1–2 Sessions/Week 45–90 minutes	• Targets: Cognitive differentiation, social perception, verbal communication, social skills, problem-solving. • Verbal Training: Social Skills Group Training. • Outcomes: Improved cognition, symptoms, and functioning. Gains maintained after 8 months.
Cognitive Remediation Therapy (CRT) Delahunty & Morice (1993)	Individual	Paper and Pencil	3 Sessions/Week 60 minutes	• Targets: Cognitive flexibility, working memory, planning. • Verbal Training: Individual coaching. • Outcomes: Improved cognition, symptoms, and functioning.
Neuropsychological Educational Approach to Remediation (NEAR) Medalia, Revheim, & Herlands (2009)	Group	Computer	2 Sessions/Week 60–120 minutes	• Targets: Working memory, attention, processing speed. • Verbal Training: 20-minute bridging group sessions. • Outcomes: Improve cognition and functional outcomes.
Cognitive Enhancement Therapy (CET) Hogarty & Flesher (1999)	Group	Computer	1 Session/Week 60–120 minutes	• Targets: Memory, attention, problem-solving, social cognition. • Verbal Training: Social skills group training. • Outcomes: Improved verbal memory, processing speed, and social cognition. Gains maintained at 2-year follow-up.
Neurocognitive Enhancement Therapy (NET) Bell, Zito, Greig, & Wexler (2009)	Group	Computer	10 Hours/Week + 2 Skills Groups	• Targets: Attention, memory, executive functioning, vocational deficits. • Verbal Training: Vocational Training group and Social Cognition group. • Outcomes: Improved cognition and vocational outcomes. Gains maintained at 2-year follow-up.
Cognitive Training Intervention (CT) Twamley, Savla, Zurhellen, Heaton, & Jeste (2008)	Group	Paper and Pencil	1 Session/Week 60 minutes	• Targets: Prospective memory, vigilance, verbal learning/memory, flexibility, executive functioning. • Verbal training: Group compensatory coaching. • Outcomes: Improved cognition, negative symptoms, functional capacity, and quality of life. • Effects on cognition, function, and quality of life maintained at 6-month follow-up.
Thinking Skills for Work (TSW) McGurk, Mueser, Feldman, Wolfe, & Pascaris (2007)	Individual	Computer	2–3 Sessions/Week 45–60 minutes	• Targets: Attention, motor speed, learning, memory, executive functioning, vocational deficits. • Verbal Training: Cognitive coaching, supported employment/training. • Outcomes: Improved cognition over supported employment alone, better work outcomes maintained at 2-year follow-up.
Neuroscience-Based Approach Vinogradov, Fisher, & de Villers-Sidani (2012)	Either	Computer	5 Sessions/Week 60 minutes	• Targets: Auditory/sensory processing, higher order cognitive functions. • Verbal Training: None. • Outcomes: Improved verbal learning/memory and cognitive control, enhanced functioning at 6-month follow-up.

administration to identify pre-existing resources that may be adaptable for a cognitive training service. Resources that are unavailable in the clinical setting would have to be purchased.

The environment for cognitive remediation must be conducive for learning, with minimized distractions, adequate lighting, and sufficient spacing. A classroom or group room that can be dedicated to running cognitive remediation sessions is best. Alternatively, when space is limited, shared space may be considered, provided that the cognitive remediation service has adequate control and use of the space for significant amounts of time during the day.

Laptop computers and tablets are more feasible hardware for group rooms given that they can be easily collected and stored after the group session. Storage and charging carts can be used to simultaneously store and charge laptops or tablets and are compact enough to be kept in the group room. At the very least, computer hardware should be able to run software or web-based platforms needed for cognitive remediation. Computer accessories (e.g., headphones, computer mice, mouse pads, and surge protectors) would be needed, along with a wired or wireless internet connection.

Step 4—Define Program Outcomes and Identify Outcome Measures

The assessment of cognitive performance, as well as effects on distal outcomes (largely psychosocial functioning and to a lesser extent symptoms), may further establish the benefits of a cognitive remediation service—and link them to the mission of the larger program. It is imperative from an administrative standpoint to consider outcomes that may be important to the overall practice setting. Examples of such program outcomes could include frequency of aggression incidents, legal competency outcomes, rehospitalization rates, community tenure, employment following discharge, pursuit of educational goals, etc.

A proposal to systematically assess such outcomes may serve to justify the development of the cognitive remediation service and later demonstrate its benefits. Most dissemination efforts have focused on the effects of cognitive remediation on functional outcomes and social behavior. It is equally useful to include client attitude surveys and feedback questionnaires to elicit information about their receptiveness of the program and their perspectives on strengths and areas of potential improvement.

Step 5—Adopt a Model of Cognitive Assessment and Training

Related to Step 4 above, understanding the nature of disorder-specific cognitive deficits can inform the assessment and treatment of cognitive deficits. Whereas schizophrenia spectrum disorders and severe mood disorders are often characterized by generalized cognitive deficits, others may reflect domain-specific impairments, such as ADHD (attention and working memory), anorexia nervosa (cognitive inflexibility), and traumatic brain injuries (e.g., executive dysfunction, impulse control).

On one hand, cognitive remediation programs could be configured to target impairment profiles of psychiatric diagnoses as laid out in the literature, but we recommend that baseline cognitive assessments always be carried out in order to evaluate the need for individualized training. A generalized approach that targets both verbal and non-verbal abilities may be suited for people with schizophrenia. It is not unusual, however, to have care recipients who demonstrate unique cognitive characteristics, such as an individual with schizophrenia whose struggles with memory are higher than expected. Existing training approaches, with demonstrated efficacy in people with schizophrenia, have been described in the literature (see Table 3).

Step 6—Recruit and Train Staff

A prospective cognitive remediation service requires a time commitment from staff members who are selected to act as cognitive remediation coaches. One experienced group facilitator may suffice to run a cognitive remediation group, but larger groups would benefit from having at least two facilitators. During group sessions, group leaders work to teach, motivate, and attend to participants by balancing support and autonomy. During bridging groups, group leaders facilitate discussions about cognitive skills, functional activities, and life goals tied to cognitive functions. It is helpful to select staff members who are energetic, conversational, engaging, and Socratic in their approach to teaching and demonstrating concepts.

Most occupational therapists, rehabilitation specialists, activity therapists, and masters-level mental health clinicians have the requisite background to serve in this capacity. We have also routinely had nurses, social workers, art therapists, and psychology graduate students and interns as cognitive remediation coaches. All staff members who serve should receive training in order to promote consistency and fidelity in the cognitive remediation service; we recommend that ongoing supervision or consultation from a psychologist be provided to support the program. There is currently no existing, widely disseminated standard for the training of cognitive remediation coaches outside of research protocols. Our staff training involves didactics on the nature of cognitive deficits in schizophrenia, cognitive remediation, the philosophical underpinnings of our cognitive remediation service, and coaching techniques (e.g., Socratic questioning). Next, coaches watch training videos that illustrate principles that facilitate effective learning during computerized training sessions and bridging groups. Videos depict client–coach interactions that illustrate guided discovery, respectful communication, bidirectional information exchange, and motivational enhancement.

We also encourage potential coaches to observe live groups from an experienced cognitive remediation coach and then co-lead groups before facilitating their own groups.

The Cognitive Training Service at New York Presbyterian Hospital

The Psychotic Disorders Division at New York Presbyterian Hospital provides cognitive remediation services as part of its broader program of psychosocial rehabilitation. Cognitive remediation groups are offered in the division's "Second Chance" program—an intermediate to long length of stay unit that serves individuals with persistent symptoms. The cognitive remediation service exists in the Second Chance program along with several behavioral skills training groups, psychoeducational groups, and recovery-based interventions. Cognitive remediation groups are also offered in the division's six-week partial hospital program along with other psychosocial treatments, including cognitive behavioral therapy for psychosis, social cognition interaction training, illness self-management, and stress management.

Cognitive remediation sessions are offered three to five times weekly in hour-long sessions. Each session includes 50 minutes of computerized remediation and a 10-minute bridging group. Participants complete 24 to 48 hours of cognitive remediation during their enrollment. The minimum dosage of cognitive remediation offered is consistent with the mean dosage reported in the literature. The cognitive remediation groups use both web-based cognitive remediation platforms and CD/DVD software.

Our interventions have used commercially available packages such as BrainHQ from Posit Science and CogPack that primarily train neurocognitive functions. Other programs such as Scientific Brain Training from Happy Neuron, Lumosity, and BrainTrain have also been used to provide cognitive exercises for people with severe mental illness. Other software or web-based platforms such as MindReading, The Interactive Guide to Emotions, and Paul Ekman's Microexpressions have been used to remediate deficits in affect recognition. Table 4 lists some available programs and relevant citations. There is currently no published evidence that any particular software outperforms others at improving overall cognitive functions in schizophrenia. It is possible that some programs are preferable for remediating certain cognitive abilities, but this remains an empirical question. With evidence supporting the efficacy of many programs, clinicians may consider incorporating several software/platforms into their library of cognitive remediation tools. This increases choices available to clients and may have the added benefit of decreasing boredom and sustaining engagement.

Our cognitive remediation service favors software programs that are continuously adaptive in the presentation of training tasks.

Table 4. *Some Commercially Available Cognitive Remediation Software Programs*

Program	Format	Clinical Targets	Website/Contact
Brain HQ	Web-Based	Neurocognition, Emotion Recognition	https://www.brainhq.com
CogPack	CD/DVD	Neurocognition	http://www.markersoftware.com/USA/frames.htm
Happy Neuron Pro	Web-Based	Neurocognition	https://www.happyneuronpro.com/en/
Lumosity	Web-Based	Neurocognition	https://www.lumosity.com
BrainTrain	CD/DVD	Neurocognition	https://www.braintrain.com
Fit Brains	Web-Based	Neurocognition	http://www.fitbrains.com
MindReading Interactive Guide to Emotions	CD/DVD	Emotion Recognition	https://www.jkp.com/uk/mind-reading.html
Paul Eckman's Microexpressions	Web-Based	Emotion Recognition	https://www.paulekman.com/micro-expressions/

For example, BrainHQ activities are adapted to the participant's level of performance, such that the individual maintains an 80% correct threshold in activities. As the individual's performance improves, computer activities presented increase in difficulty to maintain an 80% performance.

Although we allow participants who have developed some familiarity with the cognitive remediation software to choose their own preferred activities, we favor an approach that creates a training schedule for all participants. Activities are organized by their complexity and difficulty, from those that train basic sensory processing to those that train more complex cognitive skills.

Our program provides bridging groups that immediately follow computerized training sessions. The bridging draws heavily from the Neuropsychological Educational Approach to Remediation (NEAR; Medalia et al., 2009) model. The goals of bridging include increasing an awareness of cognitive skills and their relevance to community living skills—and increasing engagement of cognitive skills in the pursuit of life goals, social roles, aspirations, and hobbies.

It is our view that bridging groups are most effective when they provide a context to link newly developing cognitive and independent skills to the participant's own recovery goals. For example, the bridging discussion links attention, memory, and problem-solving to academic or vocational goals. Some participants are very aware of such links, but an explicit discussion is often critical to promoting experiential recovery. Bridging groups have the added goals of skill-building and providing education in compensatory strategies to circumvent cognitive deficits. Examples include the use of verbal tracking to aid task attention and the use of activity schedules to support deficits in organization and time management.

To the best of our knowledge, there are no currently published bridging group manuals in the literature. A recent edited text (Medalia & Bowie, 2016) includes handouts and worksheets that practitioners may find helpful for developing their own bridging curriculum. We also recommend Elizabeth Twamley's compensatory cognitive training manual available from CogSMART (www.cogsmart.com/resources) as it contains several activities, worksheets, and discussions that could also support the development of a bridging group curriculum. Our bridging group protocol developed for cognitive training coaches in our service includes a curriculum, worksheets, discussion guides and is available to interested practitioners from the first author.

Our cognitive remediation service at New York Presbyterian Hospital is modeled after our previous efforts at East Central Regional Hospital and Manhattan Psychiatric Center. Outcome studies in these settings show the benefits of our model for improving cognitive functions, symptoms, and functional capacity. Our studies also show that our cognitive remediation service contributes to reductions in aversive social behaviors such as aggression (Ahmed et al., 2015; Lindenmayer et al., 2017). Our ongoing studies at New York Presbyterian Hospital and Manhattan Psychiatric Center are examining the merits of combining the remediation of basic cognitive and social cognition deficits vis-à-vis effects on aggression in inpatients.

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