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A pilot study examining effects of group-based Cognitive Strategy Training treatment on self-reported cognitive problems, psychiatric symptoms, functioning, and compensatory strategy use in OIF/OEF combat veterans with persistent mild cognitive disorder and history of traumatic brain injury

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Abstract—We aimed to determine whether group-based Cognitive Strategy Training (CST) for combat veterans with mild cognitive disorder and a history of traumatic brain injury (TBI) has significant posttreatment effects on self-reported compensatory strategy usage, functioning, and psychiatric symptoms. Participants included 21 veterans returning from conflicts in Iraq or Afghanistan with a diagnosis of Cognitive Disorder, Not Otherwise Specified and a history of combat-related TBI. Participants attended 6- to 8-week structured CST groups designed to provide them training in and practice with a variety of compensatory cognitive strategies, including day planner usage. Of the participants, 16 completed pre- and posttreatment assessment measures. Following CST, participants reported significantly increased use of compensatory cognitive strategies and day planners; an increased perception that these strategies were useful to them; increased life satisfaction; and decreased depressive, memory, and cognitive symptom severity. Group-based CST is a promising intervention for veterans with mild cognitive disorder, and randomized controlled trials are required to further evaluate its efficacy.

Key words: blast injury, cognitive aids, cognitive rehabilitation, combat veterans, compensatory strategies, Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), postconcussive syndrome, posttraumatic stress disorder, traumatic brain injury.

Abbreviations: BDI-II = Beck Depression Inventory–Second Edition; CIQ = Community Integration Questionnaire; CST = Cognitive Strategy Training; CSTCE = CST Class Evaluation; DSM-IV = Diagnostic and Statistical Manual of Mental Disorders, 4th Edition; FCSUS = Frequency of Cognitive Strategy Usage Scale; LOC = loss of consciousness; MCQ = Memory Compensation Questionnaire; MSNQ = Multiple Sclerosis Neuropsychological Screening Questionnaire–Patient; mTBI = mild traumatic brain injury; OEF = Operation Enduring Freedom; OIF = Operation Iraqi Freedom; PCL-C = Posttraumatic Stress Disorder Checklist–Civilian Version; PRMQ = Prospective-Retrospective Memory Questionnaire; PTSD = posttraumatic stress disorder; PVAMC = Portland Department of Veterans Affairs Medical Center; SD = standard deviation; SDS = Severity of Dependence Scale; SLS = Satisfaction with Life Scale; TBI = traumatic brain injury; TBI SES = TBI Self-Efficacy Scale; UCSS = Usefulness of Cognitive Strategies Scale; VA = Department of Veterans Affairs; VAMC = VA medical center.

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INTRODUCTION

Mild traumatic brain injury (mTBI) is a high-frequency injury among combat veterans of the current conflicts in Iraq and Afghanistan (Operation Iraqi Freedom/Operation Enduring Freedom [OIF/OEF]) and has at times been described as the "signature injury" of the OIF/OEF conflicts [1]. Although modern combat body armor is highly effective in protecting combatants against potentially fatal penetration wounds, helmets are insufficient to protect brain tissue against sudden acceleration/deceleration injuries or the high- and low-pressure waves that accompany blast explosions [2–5]. Blast waves can injure brain tissue even in the absence of direct blast impact, obvious external injuries, or loss of consciousness (LOC), putting combat veterans at increased risk for mTBI [4]. Estimated rates of mTBI among OIF/OEF combatants have varied, ranging from 12 to 15 percent in OIF/OEF veterans surveyed following their return home [6–7] and up to 59 percent in an at-risk group of injured OIF/OEF military personnel receiving trauma care at Walter Reed Army Medical Center, Washington, DC [8]. The majority of these injuries are due to explosions, particularly those from improvised explosive devices [9], but others are a result of blunt objects, bullets/shrapnel, motor vehicle crashes, air/water transport, or falls [7]. As a result, the Department of Veterans Affairs (VA) is faced with providing healthcare for increasing numbers of OIF/OEF veterans who have experienced mTBI.

Research from other populations suggests that, following mTBI, most symptoms resolve within weeks or months and only a minority of individuals evidence persistent cognitive problems beyond several months [10–14]. This literature, however, does not necessarily generalize to OIF/OEF combatants, who may have experienced repeated injuries over a relatively short time period (e.g., dozens of blast exposures across several months or years) in the context of chronic stress, danger, and other cognitive risk factors inherent to a wartime environment. Indeed, the only prospective cohort-controlled study comparing objective neuropsychological performance in military personnel at pre- versus postdeployment to Iraq found that deployment was associated with deficits in attention, verbal learning, and visual-spatial memory even after controlling for the effects of head injury, stress, and depression [15]. Another study found that 43.9 percent of OIF/OEF veterans who reported combat-related LOC met criteria for posttraumatic stress disorder (PTSD), that soldiers with mTBI were more likely to report somatic symptoms as well as medical visits and missed workdays, and that PTSD and depression were important mediators of the relationship between mTBI and physical health problems in this population [6]. In a retrospective study of OIF/OEF veterans admitted to the four VA polytrauma rehabilitation centers, most veterans were found to have traumatic brain injury (TBI) and injuries to several other body systems and organs, as well as associated pain; although TBI was associated with a unique pattern of injuries, blast exposure was not predictive of functional outcomes [16]. Taken together, these studies demonstrate the complexity of risk factors that may combine to produce cognitive impairments in OIF/OEF combat veterans. These complex presentations are especially concerning because cognitive and psychiatric dysfunction can interact to create more significant impairments in adaptive functioning than would be the case for either in isolation [17]. Such findings highlight an urgent need for interventions that effectively address the cognitive problems and unique concerns faced by returning OIF/OEF veterans.

Despite the obvious and growing need to rehabilitate our OIF/OEF veterans, no published studies to date evaluate the efficacy of specific cognitive rehabilitation interventions for veterans with mTBI. Instead, cognitive rehabilitation research has primarily focused on civilian populations, typically following single events such as stroke or moderate to severe TBI. This research has been summarized in extensive literature reviews published by the European Federation of Neurological Societies [18] and the Brain Injury Special Interest Group of the American Congress of Rehabilitation Medicine [19]. In particular, these reviews conclude that cognitive rehabilitation is of significant benefit when compared with alternative treatments for TBI and other neurological disorders and that strategy training for attention deficits and mild memory impairment and the use of memory aids are effective options.

More recently, several studies have evaluated intensive rehabilitation programs for OIF/OEF veterans or Active Duty military personnel with moderate to severe TBI and complex polytrauma [16,20–21]. While these studies summarize important treatment models and outcomes for OIF/OEF veterans at this stage of care, it is not clear whether intensive multiweek inpatient interventions are feasible, affordable, or advisable for veterans with persistent mild cognitive disorders and a history of mTBI or

whether less costly outpatient interventions could be efficacious for this population.

The few studies that have examined the effectiveness of cognitive rehabilitation following mTBI have been limited to civilian populations. Several systematic reviews on this topic indicate that most trials are small or poorly designed [22–24]. They conclude that while many studies find that early education interventions are better than no treatment at all, little support exists for education following the acute stage. Moreover, research on the effectiveness of remediation approaches was deemed inconclusive in part because of diverse methodologies, samples, and interventions. In short, rehabilitation research for mTBI is in a very early stage and provides minimal guidance regarding appropriate interventions for growing numbers of OIF/OEF veterans with mild cognitive disorders due to complex etiologies.

To address this clinical and empirical gap, we designed and piloted a group-based Cognitive Strategy Training (CST) treatment for OIF/OEF veterans with mild cognitive disorder and a history of combat-related TBI. The purposes of the pilot were to determine whether the intervention was feasible with this population (e.g., Would sufficient numbers of OIF/OEF veterans enroll in and attend the group? Would they be satisfied with the intervention? Could the intervention be smoothly integrated into a typical outpatient VA medical center [VAMC] program of services?); to assess the appropriate structure, length, and duration of the intervention (e.g., Are six vs eight weekly 2-hour sessions clinically manageable?); and to evaluate the relevance of and effect sizes associated with selected outcome measures. Because no similar outcome studies have been conducted with veteran populations, it was not clear, for example, whether CST would have a significant effect on reported cognitive complaints versus psychiatric symptoms versus other functional outcomes. Thus, we selected a relatively broad range of self-report outcome measures with the objective of informing future clinical trial designs through identification of appropriate outcome variables and their associated effect sizes.

Our pilot intervention draws from the theoretical literature on compensatory strategy training for other cognitively impaired populations, a rehabilitation model that aims to teach individuals strategies that allow them to work around their cognitive deficits [25–28]. Consistent with this approach, our group-based CST treatment provided training in both internal strategies, such as visual imagery to facilitate verbal recall or formal problem-solving strategies to compensate for executive dysfunction, and in external aids, such as advanced organizers and assistive devices to promote completion of daily tasks. Our CST treatment also included graduated day planner training with a focus on using the day planner to compensate for memory and executive dysfunction as well as to schedule healthy lifestyle activities and routines (e.g., exercise, social activities, recreation). The present study reports on pilot outcome data from our group-based CST treatment. Our primary hypothesis was that, following CST, participants would report increased usage of compensatory strategies in general, increased usage of day planners specifically, and an enhanced perception that these compensatory strategies were useful. We also conducted secondary analyses to determine whether CST had significant effects on self-reported psychiatric symptom severity, cognitive symptom severity, adaptive functioning, and life satisfaction.

METHODS

Participants and Procedures

This pilot study reports on data collected from five separate CST treatment groups offered as a clinical service to eligible veterans at the Portland VAMC (PVAMC) between October 2007 and September 2008. CST is a group-based cognitive rehabilitation treatment (see curriculum described in “Design and Development of Cognitive Strategies Training Treatment” section). During this period, we notified all providers within PVAMC’s Mental Health Division about the CST treatment groups by email and we reminded staff within the Neuropsychology Clinic about the treatment groups at regular staff meetings. We also posted information about the CST treatment groups in the division’s schedule of mental health classes, which is distributed to mental health providers and available as requested to interested providers hospital-wide (e.g., primary care, rehabilitation, neurology, and polytrauma clinics). Providers then referred eligible patients to the CST treatment groups and investigators reviewed patient records to confirm clinical eligibility. Finally, investigators contacted eligible veterans to confirm their interest and availability and to enroll them into the groups. Similar to other typical mental health treatment offerings, a variety of biases may have influenced whom providers referred to our CST groups

and who ultimately enrolled. For example, because referrals were primarily from within the mental health division, patients may have been more psychiatrically distressed or more motivated to participate in psychiatric, cognitive, or group treatments than a more general OIF/OEF population.

OIF/OEF veterans were clinically eligible for CST treatment groups if record existed of an in-house or independent provider neuropsychological examination documenting a history of combat-related TBI (e.g., blast exposure, motor vehicle accidents, falls) as well as a current Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) diagnosis of Cognitive Disorder, Not Otherwise Specified [29]. Because mTBI and/or postconcussive syndromes have been inconsistently classified in the literature according to a variety of disparate systems and because patient and provider reports of remote injury severity can be unreliable, for the purposes of this pilot study, participants were eligible for CST if a neuropsychological assessment in their record indicated that they previously sustained one or more combat-related head injuries and/or blast exposures and that they presented with persistent mild (rather than severe or nonexistent) cognitive disorder at the time of the study [30]. Although in most cases neuropsychological assessments described injuries as "mild," we used no formal or prospective TBI screening measures to verify these categorizations. Therefore, it is unclear to what extent moderate or severe head injuries may have been erroneously categorized as mild. Thus, we opted for broad inclusion criteria that might be typical across outpatient VAMC settings. In other words, since it is often difficult, if not impossible, to definitively determine whether a veteran's cognitive problems are due to a history of head injury versus other cognitive risk factors and since it is difficult to accurately assess the severity of a self-reported remote head injury, we opted to focus on whether a CST intervention was effective with a sample of OIF/OEF veterans with current mild cognitive disorder that might be due to a history of self-reported head injury and/or a complexity of other risk factors. Requiring a prior neuropsychological assessment may have introduced additional selection biases (e.g., these patients may have been more inclined to report cognitive complaints or a history of head injury to their referring providers or they may have been more willing to complete a lengthy neuropsychological assessment than a more general OIF/OEF population), but it did allow us to confirm current cognitive difficulties in the mild range. Participants were no longer Active Duty and, thus, all injuries were relatively remote rather than acute.

Exclusion criteria included (1) meeting DSM-IV criteria for current substance abuse or dependence and being substance abstinent for <30 days [29], (2) meeting DSM-IV criteria for any primary psychotic disorder [29], and (3) having auditory or visual impairments that would prevent meaningful participation in groups or benefit from targeted cognitive strategies.

We asked all group participants to complete pre- and posttreatment assessment measures as part of the clinical groups for individual and program evaluation purposes. We also gave participants the option of consenting to allow data from these outcome measures to be analyzed and disseminated in aggregate form for research purposes approved by the PVAMC Institutional Review Board. We included only data from consenting subjects in the present analysis, although only one participant from these groups declined to consent.

Design and Development of Cognitive Strategies Training Treatment

CST is a group-based cognitive rehabilitation treatment designed to address the increasingly urgent needs of OIF/OEF combat veterans with mild cognitive disorder. We organized the CST curriculum into a series of modules that were semimanualized in the form of detailed class handouts. The first author (M. H.) and a cofacilitator led all CST treatment groups. Although the modules and handouts were consistent across all five groups, we structured the curriculum for the first two groups across six weekly 2-hour sessions. One purpose of this pilot study was to assess the optimal length and duration of the intervention. Thus, based on feedback from members and facilitators of the first two treatment groups, the curriculum for the third, fourth, and fifth treatment groups was structured across eight weekly 2-hour sessions. This allowed facilitators to reduce the pace at which the information was presented. Feedback from participants and facilitators suggested the eight-session groups were generally more manageable, allowed for enhanced discussion and clarification of course material, and were therefore preferred over the six-session groups.

The CST treatment groups consisted of interactive didactic presentations, in-class discussions, and activities that introduced participants to a variety of cognitive strategies (e.g., acronyms or visual imagery to assist with

memory, mindfulness exercises to focus attention, removing environmental distractions to improve concentration) and external aids (e.g., timers, visual reminders, day planners). Didactics and exercises focused on the following important modules related to the management of and compensation for symptoms associated with mild cognitive disorder: (1) course overview and psychoeducation, (2) lifestyle strategies, (3) organizational strategies—routines and prioritization, (4) attention strategies, (5) memory strategies, and (6) goal planning and problem solving strategies. We generally sequenced the curriculum from simple to more complex skills, with cumulative review provided. We delivered CST so that the facilitator first presented each skill or strategy, then modeled and practiced it through class activities. Participants then practiced skills at home in their daily lives and, finally, discussed them at subsequent sessions so that a range of applications and examples could be reviewed and corrective feedback could be provided. Thus, each session had the following general structure:

1. Home exercise review—feedback and generalization of skills.
2. Interactive didactics—presentation of new information and strategies.
3. Class activities and discussion—strategy modeling and practice.
4. Home exercise assignment—strategy application to daily life.

All sessions also included one 10- to 15-minute break after approximately 1 hour, as well as 2- to 5-minute breaks as needed every 20 to 30 minutes. To the extent possible, we offered individual or small-group make-up sessions to participants who missed group treatment sessions following reasonable occurrences (e.g., illness, out of town). **Table 1** summarizes the CST curriculum and lists the relevant concepts, strategies, class activities, and home exercises addressed in each module.

We gave all participants detailed class handouts summarizing session content, a binder in which to store the class handouts and home exercises, and a comprehensive day planner system prescribed as an assistive device at no cost. We intended day planners to help participants compensate for memory problems (e.g., to-do lists, calendars for appointments, pages for note-taking) as well as executive problems (e.g., a page finder that serves as a daily reminder of major life priorities, a daily page layout that facilitates a system for prioritizing tasks and structuring participant's day according to priorities). Participants received extensive graduated training in and practice with their day planners across sessions (i.e., introduction to and practice with one or two elements per week), with a particular focus on how the day planners could facilitate their use of the other compensatory strategies taught in class that week (e.g., writing down important information for later reference, breaking tasks down into smaller steps, prioritizing healthy habits and other important life goals, using and storing worksheets to aid with goal planning and problem solving). For this particular intervention, we selected the Franklin Covey® (West Valley City, Utah) day planner system because of its flexible and customizable features (e.g., three-ring leather-bound case with pockets for money, cards, and pencils; removable page finder with inserts for listing important life priorities and roles; monthly calendars and tabs; two-page insert per date with prioritized daily task list, appointment schedule, and blank daily notes page; customizable tabs for storage of information by topic, project, or goal; and alphabetized tabs for storage of phone numbers and contact information). We encouraged participants to bring their class binders and day planners to each treatment session.

Pre- and Posttreatment Assessment Measures

Consenting participants completed a battery of questionnaires before and after the CST intervention. We used the same set of questionnaires, with some items reworded as appropriate to time of administration, for both the pre- and posttreatment assessments. We administered the pretreatment assessment battery during the first session or assigned it as a home exercise to return at the second session. For participants in the six-session treatment groups, participants completed posttreatment assessments during the final session or returned them by mail. For participants in the eight-session treatment groups, we assigned posttreatment assessments as a home exercise following the seventh session to return at the final session. We designed pre- and posttreatment assessment batteries to assess psychiatric symptom severity, cognitive symptom severity, adaptive functioning and life satisfaction, and cognitive compensation, including both the frequency and usefulness of cognitive strategy implementation.

Primary Outcome Measures

Cognitive Compensation—Frequency and Perceived Usefulness of Strategy Implementation

- Memory Compensation Questionnaire (MCQ) [31]. This scale asks participants to rate the extent to which

Table 1.
Summary of Portland, Oregon, group-based Cognitive Strategy Training treatment.

Cognitive Strategy Training	Concepts	Strategies	Class Activities	Home Exercises
Psychoeducation*	The brain is complex and controls a range of functions including cognition, emotion, movement, drives, and regulatory functions. The basic definition and mechanisms of traumatic brain injury and postconcussive syndrome. The basic definition of cognitive disorder and discussion of the full range of related risk factors.	Define internal strategies and external aids. Provide examples.	Perform introductions: As an example of internal strategies, ask participants to introduce themselves with their name and a catchy phrase to help participants remember them (e.g., "Marilyn Marathon"). Also, have participants visualize the catchy phrase that describes each person (e.g., Marilyn running). Review course overview. Review day planners and class binders. Emphasize that the day planner is an example of an external aid.	Identify a routine "home" for most important personal items—wallet, cell phone, keys, day planner, and class binder. Identify class goals.
Lifestyle Strategies	Individuals with cognitive disorders need to give their bodies and brains optimal conditions to function well.	Avoid additional head injuries. Minimize intake of and contact with substances (alcohol, caffeine, toxic fumes) that interfere with brain healing and function. Consume a healthy diet with plenty of water. Exercise the body and mind. Attend to sleep hygiene. Find some time to relax and have fun every day. Practice good pacing, take breaks, and learn limits. Stop activities before wearing out.	Write down three to four life priorities on page finder/bookmark in day planner to give a visual reminder of what is most important to spend time on in life. Are you prioritizing your health and lifestyle strategies? Highlight two to three lifestyle strategies summarized in the class handouts to practice more often in daily life. Practice scheduling one of these lifestyle strategies into each day in day planner for the coming week.	Practice referring to day planner at least three times per day. Use day planner as reminder to do the lifestyle strategies scheduled this week.

Table 1. (cont)
Summary of Portland, Oregon, group-based Cognitive Strategy Training treatment.

Cognitive Strategy Training	Concepts	Strategies	Class Activities	Home Exercises
Organizational Strategies: Routines and Prioritization	Routines reduce risk of error, require less energy, ensure that important tasks and goals are attended to, and help manage problems with mood, anxiety, and cognition. Routines can involve a regular time, space, and/or method for doing an activity. Immediacy vs importance—we often prioritize an activity because it is happening now or has a deadline, so it feels urgent. However, many of the most important activities in life (e.g., prevention, exercise, relationships, planning, self-care, and pleasure) have no deadlines.	Build routines to help attend to mundane tasks (e.g., getting ready in the morning, taking medications), important life goals and priorities (e.g., exercise schedule, designated family day), or seasonal events (e.g., anniversary dinner, annual yard raking day). Use to-do lists to brainstorm and prioritize daily and monthly activities. Use day planners and calendars to help organize time and develop routines. Schedule time for the most important activities and life priorities first. Don't sweat the small stuff.	Read a parable about filling a bucket first with large rocks, then with pebbles, then sand, and finally water, noting that if done in reverse, the rocks would never fit. The principle is to schedule the important things in life first. Use a 2 × 2 table to categorize a list of activities, first as "Important vs Not Important," then as "Immediate vs Not Immediate." Discuss the extent to which time is allotted in life for the items classified in the "Important/Not Immediate" quadrant. Practice using the to-do lists in day planner to brainstorm any activities wanted for tomorrow. Then prioritize them numerically, keeping in mind the life priorities listed on the page finder. The facilitator can demonstrate an example of this on the board.	Practice using the prioratized to-do lists, appointment schedules, and monthly calendars in day planner three or more times per day to help structure each day. Try to allot enough time for the most important activities, and don't be afraid to move unimportant items to future days. Use day planner to track appointments as they are scheduled.
Attention Strategies	There are increasingly difficult levels of attention ranging from simple focused attention to sustained attention to selective, alternate, and divided attention. Higher levels of attention require more energy and increase	Minimize internal distractions by attending to bodily needs before a task. Use mindfulness exercises to focus attention and minimize distracting thoughts or intrusive emotions. Minimize external distractions. Find a quiet	Practice one or several mindfulness/breathing exercises in class. Discuss how each attention strategy serves to bring a task down to a lower level of attention. Highlight two or three attention strategies from class handouts	Use day planner and/or another visual reminder to help practice the attention strategies highlighted several times per day this week. Identify one challenging yet important activity to do this week.

Table 1. (cont)
Summary of Portland, Oregon, group-based Cognitive Strategy Training treatment.

Cognitive Strategy Training	Concepts	Strategies	Class Activities	Home Exercises
Attention Strategies (cont)	the chance of error. Attention strategies attempt to structure a task or situation so that it requires lower levels of attention.	space to work in. Use ear plugs or a fan to drown out noise. Avoid multitasking. Avoid interruptions. Use a "Do Not Disturb" sign, or ask others not to interrupt. Break tasks down into short, manageable steps. Take short breaks in between steps. Hang the list of steps in clear view to keep on track. Use a timer and/or day planner to help periodically evaluate task pace.	to practice more often in life.	Try breaking the task down into steps, and practice taking breaks in between each step.
Memory Strategies	Memory is the ability to store and retrieve information. There are different levels of memory ranging from sensory to short-term to long-term memory. Attention helps move information from sensory to short-term memory. Active memory strategies help organize information so that it is easier to retrieve later. They help move information from short-term to long-term memory. Active memory strategies require time and energy. Because not all information is important to store in long-term memory and because time and energy are limited, it is better to use external aids to help track short-term details only (e.g., appointments, telephone	Work with information in multiple modalities—listen, read, write, draw, act out, or experience it. Process information at higher levels of thought—reorganize the information into meaningful chunks or categories, discuss it with someone, teach it to someone, do something creative with it. Turn the information into something more memorable—mnemonics, catchy phrases, jokes, songs, stories, or rhymes. Turn the information into visual images—draw pictures of it, imagine it as a movie or visual story, make charts or graphs of it. Use day planners, PDAs, calendars, and to-do lists. Write important	Review four lists of words, one at a time. Listen to the first list and immediately write down as many words as recalled. Read the second list individually and immediately write down as many words as recalled. Organize the third list of words into categories and then turn the items and categories into a mnemonic before recall. Draw the fourth list of words into a picture or visual story before recall. Discuss which modalities and strategies worked best. Highlight two or three memory strategies on class handouts to practice more often in life. Label tabs in day planner behind	Use day planner and/or another visual reminder to help practice the highlighted active memory strategies several times per day. Practice using a timer or alarm each day to help remember to do something important. Practice using the daily note pages in day planner to jot down important information throughout each day (e.g., directions to an appointment). Store information to refer to regularly behind the labeled tabs in day planner.

Table 1. (cont)
Summary of Portland, Oregon, group-based Cognitive Strategy Training treatment.

Cognitive Strategy Training	Concepts	Strategies	Class Activities	Home Exercises
Memory Strategies (cont)	numbers, grocery lists).	information down for later reference and store/file notes in an organized manner. Use timers, alarms, automated prompts voice recorders, and navigational devices.	which important information can be stored by project, goal, or activity (e.g., finances, grocery, health, work, home repair, recreation, addresses/contact numbers).	—
Planning and Problem-Solving Strategies	Long-term problems, goals, and projects often appear overwhelming, but planning worksheets can be used to get started, break the goal down into manageable steps, and keep on track.	Schedule time to plan. Define goal, project, or problem. Examples could include addressing a relationship or health concern or working toward a new career. Brainstorm many small steps that might address goal. Prioritize several of these items as "next steps" based on importance, feasibility, and/or a logical sequence. Begin using day planner to schedule a few of these steps at a time. Consider developing a routine time, place, or method to work toward goal. Schedule time to plan again. Periodically reevaluate progress toward goal, and then rebrainstorm, reprioritize, and reschedule as needed. Stay flexible and revise plans and goals periodically.	Practice using a planning worksheet in class toward an important life problem or goal. The facilitator can also demonstrate an example of this on the board. Label a tab in day planner devoted to this goal. Store the worksheet in that section for later reference and planning.	Practice using a planning worksheet toward a different life goal or problem. Evaluate the progress made toward original class goals. What are the most important changes made? Identify one or two cognitive problems that still need to be addressed.
Review and Integration†	Class binder and handouts are a toolbox of strategies that can be used to compensate for cognitive problems.	—	Review lifestyle, attention, and memory strategies using handouts that briefly summarize each	—

Table 1. (cont)
Summary of Portland, Oregon, group-based Cognitive Strategy Training treatment.

Cognitive Strategy Training	Concepts	Strategies	Class Activities	Home Exercises
Review and Integration[†] (cont)	Each strategy requires practice and may not work the first time or for all problems. It is also normal to forget to use strategies after a period, so review them periodically. If cognitive problems become more prevalent, reread handouts and select one or several tools to help address concerns. Also, consult with healthcare providers or trusted others.	—	module in a new way. Use active memory strategies during the review to consolidate the information. For example, draw a picture of each lifestyle strategy and then turn the attention strategies into a song, story, or rhyme.[‡] Name and describe one or two cognitive strategies found to be most useful. Use a planning worksheet to develop a plan to work on remaining cognitive problems after the class is over.[‡] Say good-byes.	—

[*]Participants can optionally bring family member, friend, or support person to attend psychoeducation session.
[†]Participants can optionally bring family member, friend, or support person to attend review section of final class.
[‡]Not offered consistently to all groups. However, all other concepts, strategies, class activities, and home exercises listed in this chart were offered to all participants in all groups.
PDA = personal digital assistant.

they use various strategies to improve memory and organization performance relevant to daily living. Each item is rated on a 5-point scale (0–4), with higher scores indicating greater use of memory compensation strategies. We selected this scale as our primary outcome measure because it has been previously validated for use with cognitively impaired populations [31].

- Frequency of Cognitive Strategy Usage Scale (FCSUS). We designed this scale for use in this study, and it asks participants to rate how often they use each compensatory strategy or aid listed on the measure. Each item is rated on a 4-point scale (0–3), with greater scores reflecting higher frequency of use. **Appendix 1** (available online only) includes the scale items. Although we intended this scale to measure a similar construct as the MCQ, we worded items to more specifically target the unique set of strategies that we focused on in our CST intervention (e.g., item 10, use of day planners and calendars). Thus, we hypothesized that effect sizes would be larger with relation to the FCSUS than the MCQ, which was not specifically tailored to our intervention.
- Usefulness of Cognitive Strategies Scale (UCSS). We designed this scale for use in this study, and it asks participants to rate how useful they find each strategy or aid listed on the measure. Each item is rated on a 3-point scale (0–2), with greater scores reflecting greater usefulness. **Appendix 2** (available online only) includes the scale items. Unlike the MCQ and the FCSUS, which focus on frequency of use, we intended this scale to assess participants' attitudes toward the specific set of strategies focused on in our CST intervention.
- Cognitive Strategies Training Class Evaluation (CSTCE). We designed this evaluation form for use in

this study. We intended scale items to be analyzed separately, and **Appendix 3** (available online only) includes the scale items. While we primarily designed the FCSUS and UCSS for generation of total scale scores, we included CSTCE items in this pilot to determine if single items were sufficient for measurement of similar constructs (i.e., frequency and usefulness of strategy usage) in future studies or if longer scales like the MCQ, FCSUS, and UCSS would be necessary to generate enough variability and power to detect effects.

Related Planned Primary Analyses

Our primary hypothesis was that, following CST, participants would report increased use of compensatory strategies in general (MCQ mean scale score, FCSUS mean scale score, CSTCE mean item 4 score), increased use of day planners specifically (FCSUS mean item 10 score), and an enhanced perception that these compensatory strategies were useful (UCSS mean scale score, UCSS mean item 10 score, CSTCE mean item 2–3 scores).

Secondary Outcome Measures

Psychiatric Symptom Severity

- PTSD Checklist–Civilian Version (PCL-C) [32]. The PCL-C is a 17-item self-report questionnaire assessing PTSD symptom severity. Each item is rated on a 5-point scale (1–5), with higher scores indicating greater severity of PTSD symptoms.
- Beck Depression Inventory–Second Edition (BDI-II) [33]. This is a 21-item depressive symptom inventory. Each item is rated on a 4-point scale (0–3), with higher scores reflecting greater symptom severity.
- Severity of Dependence Scale (SDS) [34]. This brief 5-item questionnaire assesses severity of substance abuse and dependence. Each item is rated on a 4-point scale (0–3), with higher scores reflecting greater degree of dependence.

Cognitive Symptom Severity

- Multiple Sclerosis Neuropsychological Screening Questionnaire–Patient (MSNQ) [35]. This brief 15-item measure asks participants to rate the degree to which they are having various problems related primarily to attention and organization. Although designed and validated for use with patients diagnosed with multiple sclerosis, the problems addressed by this questionnaire are similar to those experienced by mTBI patients. Each item is rated on a 5-point scale (0–4), with higher scores reflecting greater levels of impairment.
- Prospective-Retrospective Memory Questionnaire (PRMQ) [36]. This brief 16-item measure asks participants to rate the frequency with which they are having problems with various aspects of everyday memory functioning. Each item is rated on a 5-point scale (1–5), with higher scores reflecting greater levels of memory impairment.

Adaptive Functioning and Life Satisfaction

- Community Integration Questionnaire (CIQ) [37]. This measure assesses participation in community and social activities. Each of the first 11 item responses is given a score ranging from 0 to 2, while the last three items are combined to obtain an item score that ranges from 0 to 5. Higher scores reflect greater functional independence and community integration.
- Satisfaction with Life Scale (SLS) [38]. This is a brief 5-item quality-of-life measure. Each item is rated on a 7-point scale, with higher scores reflecting greater satisfaction.
- TBI Self-Efficacy Scale (TBI SES). We designed this scale for use in this study, and it asks participants to rate how capable they are of managing symptoms related to TBI. Each item is rated on an 11-point scale (0–10), with higher scores reflecting a greater sense of self-efficacy. **Appendix 4** (available online only) includes the scale items.

Related Planned Secondary Analyses

We conducted secondary analyses to determine whether CST had significant effects on self-reported psychiatric symptom severity (PCL-C, BDI-II, and SDS mean scale scores), cognitive symptom severity (MSNQ and PRMQ mean scale scores), adaptive functioning (CIQ mean scale score), life satisfaction (SLS mean scale score), and self-efficacy (TBI SES mean scale score).

RESULTS

Participant Demographics and Characteristics

Twenty-one veterans consented to participate and completed pretreatment assessments. Of the participants, 16 (76.2%) completed posttreatment assessments. Of the

five participants who did not complete posttreatment assessments, one dropped out after two sessions because he moved and four completed the CST treatment group but did not return a completed posttreatment assessment. Compared with those who completed posttreatment assessments, those who did not complete posttreatment assessments attended fewer CST sessions (90% vs 62%). All participants were men, with 32.8 ± 12.7 months (mean ± standard deviation [SD]) since their most recent TBI. We included only data from veterans completing both pre- and posttreatment assessments in subsequent analyses, and **Table 2** summarizes their baseline demographics and characteristics.

Class Attendance and Satisfaction

In the subset of participants who completed posttreatment assessments, attendance rates were high. Participants attended an average of 80 percent of all group treatment sessions and 90 percent of all sessions after including individual and small group make-up sessions. Participants were highly satisfied with the CST treatment (CSTCE posttreatment assessment mean ± SD item 5 score = 8.69/10 ± 1.4), and they rated the treatment as highly useful (CSTCE posttreatment assessment mean ± SD item 1 score = 7.81/10 ± 1.1). In the posttreatment assessments, we asked participants what was most helpful about the treatment. The following written responses capture participants' reactions to the CST treatment:

Table 2.
Demographic and baseline characteristics of veterans completing group-based Cognitive Strategy Training treatment (*n* = 16).

Characteristic	Posttreatment Assessment
Demographics	
Age (years, mean ± SD)	33.8 ± 8.4
Male, *n* (%)	16 (100)
Caucasian, *n* (%)	13 (81)
Education (years, mean ± SD)	13.3 ± 1.7
Baseline Characteristics	
Months since TBI (mean ± SD)	33.8 ± 12.2
Psychotropic medications during treatment period, *n* (%)	13 (81)
Mental health services during treatment period, *n* (%)	14 (87)
Speech therapy during treatment period, *n* (%)	3 (19)
Group Attendance (mean % of classes attended ± SD)	90.0 ± 12.3

SD = standard deviation, TBI = traumatic brain injury.

- "I found the daily planner unbelievably helpful and tied it with strategies very fluidly."
- "Identifying strategies to cope with memory. I enjoyed [the] group setting. I felt more comfortable knowing I'm not the only one dealing with cognitive issues."
- "Helping me to become better organized and make use of external aids more efficiently."
- "Learning to group things together to be able to get to them later."
- "Like me, everyone needs a start. This was mine. This class gave me idea[s]—using a [digital] recorder to record information will probably be something I use a lot. I have a bad memory and now I can always go back and practice methods taught in this class."

Outcomes

Table 3 summarizes paired-samples *t*-tests we used to evaluate the effect of our CST group treatment on participants' self-reported outcomes. We set alpha for significance at 0.05. We estimated effect sizes using Cohen's *d*.

Primary Hypotheses–Cognitive Compensation

Following CST, participants reported significantly increased use of compensatory strategies in general (MCQ mean scale score), in their combined use of the specific compensatory cognitive strategies presented in class (FCSUS mean scale score), and in their specific use of day planners (FCSUS mean item 10 score). At posttreatment, participants also perceived the following to be significantly more useful to them in their daily lives: the specific compensatory cognitive strategies presented in class (UCSS mean scale score), internal cognitive strategies in general (CSTCE mean item 2 score), external cognitive aids in general (CSTCE mean item 3 score), and day planners specifically (UCSS mean item 10 score).

Secondary Analyses

Psychiatric symptom severity. Participants reported clinically significant levels of PTSD (PCL-C) and depressive symptomotology (BDI-II), with mean depressive severity falling in the moderate range at baseline, and average PTSD scores falling above the recommended cutoffs for clinically significant PTSD. Following CST, participants reported significantly lower levels of depressive symptoms (BDI-II). Participants did not report high levels of substance use and dependence (SDS) at pre- or posttreatment, and we found no significant change in reported PTSD symptom severity following CST.

Table 3.
Effect of group-based Cognitive Strategy Training on self-reported symptoms, functioning, and compensatory strategy use (n = 16).

Effect	Pretreatment Assessment Score	Posttreatment Assessment Score	*df*	*t*	*p*-Value	Effect Size Cohen's *d*
Class Satisfaction						
Overall usefulness of class (**Appendix 3*** [mean item 1 score ± SD])	—	7.81 ± 1.11	—	—	—	—
Overall satisfaction with class (**Appendix 3*** [mean item 5 score ± SD])	—	8.69 ± 1.40	—	—	—	—
Cognitive Compensation—Frequency of Strategy Use						
MCQ	116.56 ± 24.67	128.25 ± 20.07	15	–2.57	0.021	0.54
Frequency of specific strategy use (**Appendix 1*** [mean scale score ± SD])	22.00 ± 12.60	41.04 ± 8.19	11	–5.06	0.000	1.87
Overall use of strategies and aids (**Appendix 3*** [mean item 4 score ± SD])	6.56 ± 2.31	7.25 ± 2.14	15	–1.03	0.32	0.32
Cognitive Compensation—Perceived Usefulness of Strategies						
Combined usefulness of specific strategies (**Appendix 2*** [mean scale score ± SD])	17.08 ± 7.56	28.58 ± 3.58	11	–5.66	0.000	2.03
Overall usefulness of cognitive strategies (**Appendix 3*** [mean item 2 score ± SD])	6.25 ± 1.88	7.94 ± 1.34	15	–3.45	0.004	1.07
Overall usefulness of external aids (**Appendix 3*** [mean item 3 score ± SD])	7.27 ± 1.98	9.00 ± 1.20	15	–4.38	0.001	1.10
Cognitive Compensation—Day Planner Use and Usefulness						
Frequency of day planner use (**Appendix 1*** [mean item 10 score ± SD])	1.58 ± 1.44	2.75 ± 0.62	11	–2.3	0.041	3.81
Usefulness of day planners (**Appendix 2*** [mean item 10 score ± SD])	1.25 ± 0.62	2.00 ± 0.00	11	–4.18	0.002	1.78
Psychiatric Symptom Severity						
BDI-II	25.94 ± 12.79	22.25 ± 13.20	15	2.86	0.012	0.14
PCL-C	58.81 ± 15.21	55.16 ± 13.10	15	1.695	0.111	0.27
SDS	1.06 ± 2.96	0.69 ± 1.74	15	0.972	0.347	0.16
Cognitive Symptom Severity						
MSNQ	41.5 ± 10.12	36.19 ± 9.03	15	2.34	0.034	0.57
PRMQ	57.31 ± 10.92	52.56 ± 11.71	15	3.01	0.009	0.43
Adaptive Functioning and Satisfaction with Life						
CIQ	13.67 ± 3.42	14.41 ± 3.02	15	–1.26	0.227	0.24
SLS	16.75 ± 6.70	19.00 ± 7.29	15	–2.25	0.040	0.33
TBI SES (**Appendix 4***)	23.56 ± 12.44	29.38 ± 15.97	15	–1.84	0.085	0.11

Note: Data expressed as mean total score ± SD unless otherwise noted. *p*-Values reflect differences between pretreatment and posttreatment assessment scores based on paired *t*-tests.

*Available online only.

BDI-II = Beck Depression Inventory–Second Edition, CIQ = Community Integration Questionnaire, *df* = degrees of freedom, MCQ = Memory Compensation Questionnaire, MSNQ = Multiple Sclerosis Neuropsychological Screening Questionnaire, PCL-C = Posttraumatic Stress Disorder Checklist–Civilian, PRMQ = Prospective-Retrospective Memory Questionnaire, SD = standard deviation, SDS = Substance Dependence Severity Scale, SLS = Satisfaction with Life Scale, TBI SES = Traumatic Brain Injury Self Efficacy Scale.

Cognitive Symptom Severity. Participants reported significantly lower levels of memory (MSNQ) and overall cognitive impairment (PRMQ) following CST.

Adaptive Functioning and Life Satisfaction. Most participants reported high levels of independence and integration at baseline, and they reported no significant changes in community integration levels (CIQ) following CST. Participants reported a significant increase in life satisfaction following CST (SLS). Although we found a trend toward participants reporting a higher level of TBI-related self-efficacy (TBI SES) following CST, the difference between pre- and posttreatment levels did not reach statistical significance.

DISCUSSION

The present study indicates that group-based CST treatment is associated with promising outcomes in OIF/OEF veterans with persistent mild cognitive impairments and a history of combat-related TBI. Compared with baseline pretreatment levels, our sample of OIF/OEF veterans reported significantly increased use and perceived usefulness of cognitive compensation aids and strategies, reduced depression and cognitive symptom severity, and increased life satisfaction following CST. Thus, following 6 to 8 weeks of group-based CST, our veterans used the compensatory strategies taught in the class and felt these strategies were useful to them in their daily lives.

We found these preliminary results consistent with previous literature demonstrating that strategy training is effective with civilians following single events such as stroke or moderate to severe TBI [18–19] as well as with patients with schizophrenia [25,27–28]. The present study, however, indicates that CST may also be efficacious with a diverse population of veterans with mild cognitive disorders due to poorly understood and complex etiologies. Indeed, OIF/OEF veterans frequently report repeated blast exposures, motor vehicle accidents, falls, and/or other head injuries that might be characterized as mTBI, all occurring in the wartime context of chronic stress and life-threatening danger, prolonged sleep deprivation, and other environmental challenges that can contribute to cognitive sequelae [4,15]. These veterans also return from combat with a variety of medical and psychiatric comorbidities, particularly PTSD, that may cause, exaggerate, or otherwise contribute to cognitive impairments [6]. Researchers are therefore faced with the important challenge of teasing apart the various mechanisms that may lead to cognitive dysfunction in combat veterans, once again raising the historical controversy regarding the diagnostic validity of persistent postconcussive syndrome and mTBI [30]. Despite diagnostic and etiological ambiguity, VA healthcare providers need to know what interventions will help their increasing caseloads of OIF/OEF veterans with cognitive difficulties. Although the present study design does not allow us to differentiate between the cognitive effect of various types of combat-related risk factors (e.g., blast exposure vs PTSD), it instead suggests that group-based CST treatment can be efficacious with a typical OIF/OEF veteran population presenting with mild cognitive impairments, a history of TBI, and a diverse range of other cognitive risk factors.

Group-based rehabilitation interventions are highly attractive options for VAMCs because they capitalize on limited staff resources and can be integrated into the menu of mental health and rehabilitation classes that a typical VAMC already provides. Data from this study, therefore, provide VAMCs with a practical outpatient treatment option for growing numbers of OIF/OEF veterans. Our group-based CST treatment proved feasible to deliver, had high group attendance, and resulted in highly satisfied participants.

The reduction in depressive symptoms and increase in life satisfaction in our OIF/OEF sample is noteworthy given that our treatment focused on compensatory cognitive strategies rather than targeting the emotional difficulties that often co-occur with TBI. However, these findings should be interpreted cautiously because average posttreatment levels of both depressive and PTSD symptom severity remained in clinically significant ranges. Nevertheless, it is possible, for example, that greater use of cognitive compensation strategies contributed to increases in self-efficacy and hopefulness. Alternatively, our CST treatment focused one session on lifestyle strategies, including healthy diet, exercise, minimizing alcohol and caffeine intake, sleep hygiene, attending to important relationships, taking frequent breaks, and finding time to relax each day. We then used day planners to structure these activities into each veteran's daily life and to facilitate routines that addressed each participant's important life priorities. While serving to optimize conditions for healthy brain function as well as compensate for difficulties with

memory, organization, and initiation, these strategies are also similar to aspects of cognitive-behavioral therapy and behavioral activation therapy for depression.

Growing support already exists for the relationship between cognitive and emotional factors in recovery following TBI. Mateer et al. called for an integrative approach to TBI interventions and noted the connection between improved memory functioning and decreased worry and distress, emphasizing the need to increase self-efficacy and emotional coping with cognitive failures [39–40]. In a similar vein, Hoge et al. argued that the associations between mTBI, depression, and PTSD in the OIF/OEF population highlight the need for a multidisciplinary approach to treatment that includes treatments targeted toward mental health problems [6].

In line with its purpose of informing future interventions and investigations, our pilot study taught us a variety of useful lessons:

1. Treatment content, structure, and duration—Our experience suggested that the content was clinically appropriate for and well-received by this population, but that it was more manageably paced across eight weekly 2-hour sessions rather than six. Patients appeared better able to focus when we provided short 2- to 5-minute breaks (e.g., for a structured mindfulness exercise, or for unstructured time to walk around, stretch, or close their eyes) every 20 to 30 minutes, as well as a lengthier 10- to 15-minute break to leave the room after the first hour. Feedback indicated that weekly reminder calls a day or so before class improved attendance and facilitated home exercise completion and that make-up sessions for reasonable absences enhanced motivation for and comprehension of the class.
2. Eligibility criteria—Our experience suggested that CST was appropriate for combat veterans with persistent mild cognitive impairment due to mixed and perhaps uncertain etiologies, including a reported history of TBI. However, because determination of severity or type of head injury is likely to be unreliable with combat veterans and because present functioning is a more proximal indication of treatment need than the severity of any remote injury, we would recommend that CST eligibility be based on current cognitive functioning rather than injury severity.
3. Cognitive compensation measures—Because the effect sizes were larger for scales (e.g., MCQ, FCSUS, UCSS) than single CSTCE items meant to capture similar constructs, we would not recommend using CSTCE items as outcome measures in future clinical trials, except perhaps as posttreatment ratings of overall satisfaction (items 1 and 5). Because the scales we tailored to reflect the specific elements of our CST intervention (i.e., FCSUS and UCSS) had larger effect sizes than the MCQ, a previously validated but less specific measure of cognitive compensation, additional validation (e.g., reliability studies) of the FCSUS and UCSS for use in future CST trials is warranted.
4. Other outcome measures—Our pilot study revealed significant effects of CST on psychiatric functioning, cognitive functioning, and life satisfaction; therefore, related measures appear appropriate for use in future outcome studies. Effects on TBI SES were nonsignificant, so it is unclear whether this measure requires revision, whether there was inadequate power to detect change, or whether this construct was less relevant to the intervention. Effects on the CIQ were also nonsignificant, and high baseline scores suggested this scale was inappropriate for this highly independent population; alternative measures of social functioning could, however, be considered for future trials.
5. Day planners—We opted to distribute comprehensive day planner systems and to emphasize graduated day planner training as part of our CST intervention. Based on feedback from participants as well as robust effect sizes on related item scores (i.e., mean item 10 scores on the FCSUS and UCSS), day planner training appeared to be a critical and highly effective component of CST. Future investigators might also consider assessing the effectiveness of electronic versus paper-based planner systems or of offering a variety of options to participants versus distributing a common system to all group participants.
6. Other benefits—Although not directly measured, our clinical experience suggests that CST may be an effective way to reach OIF/OEF veterans and to engage them into treatment. For example, some veterans who might otherwise be reluctant to engage in PTSD or other more intensive or process-oriented treatments may be more willing to start out with CST as a practical, nonthreatening, and nonstigmatizing intervention.

Although results from our pilot study are encouraging, several important limitations must be considered. First, the study was limited by a small sample size, so it is unclear to what extent sample characteristics are generalizable to the larger OIF/OEF population or whether unintended sampling biases may have affected results (e.g., if

providers tended to refer patients who were more motivated or engaged or who were more likely to voice complaints about cognitive difficulties). Small sample size may also have limited our power to detect certain outcomes (e.g., self-efficacy). Therefore, these results should be considered preliminary until replicated with larger samples. Second, the absence of a comparison group precludes attributing improvements to CST versus spontaneous recovery, nonspecific therapeutic factors, or other concurrent treatments. For example, 87 percent of those completing posttreatment assessments were concurrently engaged in either mental health therapy or psychiatric medication management, and the extent to which this may have contributed to reductions in depressive and cognitive symptom severity is unknown. However, given that the range of time since injury varied widely in our sample, spontaneous recovery is unlikely to fully account for the full range of significant findings. Third, the current pilot study does not address whether or not treatment gains are sustained long-term, and short-term improvements are of far less value to a patient if they cannot be maintained following completion of a CST group. Future outcome studies should therefore explore outcomes 6 to 12 months following group termination. Fourth, all our measures were self-report, raising the possibility that participants reported improvements because they felt positively toward the facilitators or the group. Future outcome studies could include collateral ratings from family members or other providers, behavioral indices such as healthcare no-show rates or vocational evaluations, or objective cognitive tests to further explore and confirm the range of outcomes.

CONCLUSIONS

Our findings indicate that group-based CST treatment has beneficial effects on the frequency with which cognitive compensation strategies are used and may aid in the reduction of cognitive and psychological symptoms. These pilot study findings, although preliminary, suggest that this form of cognitive rehabilitation may provide benefits for the types of symptoms experienced by a growing number of OIF/OEF veterans with mild cognitive disorder. Given our robust effect sizes, a larger outcome study is now warranted and should include a randomized control group, fidelity monitoring, and multimodal assessment measures, as well as evaluation of the sustainability of treatment outcomes.

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