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A multidisciplinary TBI inpatient rehabilitation programme for active duty service members as part of a randomized clinical trial

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Objective: To design and describe an effective rehabilitation programme for use in an ongoing trial on the efficacy of multidisciplinary brain injury rehabilitation for moderately head injured military service members.
Design: Treatment arm of a randomized control trial.
Setting: US military tertiary care hospital inpatient rehabilitation programme.
Patients: Sixty seven active duty military with moderate to severe TBI who were randomized to the treatment arm of the protocol.
Intervention : Eight week rehabilitation programme combining group and individual therapies with an inpatient milieu-oriented neuropsychological focus. Group therapies included fitness, planning and organization, cognitive skills, work skills, medication, and milieu groups, and community re-entry outings. Individual therapy included neuropsychology, work therapy, occupational therapy, and speech and language pathology.
Main outcome measures: Successful return to work and return to duty.
Results: At 1 year follow-up, 64 patients returned to work (96%) and 66% (44/67) returned to duty.
Conclusion: The described rehabilitation programme demonstrates one successful effort to rehabilitate active duty military service members with TBI who have the potential to return to duty.

Introduction

Traumatic Brain Injury (TBI) continues to be a principal cause of death and disability for Americans under the age of 35. 75 to 90 per cent of these injuries are mild

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or moderate, and such patients usually have good potential for return to work. Rehabilitation programmes abound for this population, despite little scientific evidence as to their efficacy. The Defense and Veterans Head Injury Program (DVHIP) is conducting several model TBI rehabilitation projects in the context of controlled clinical studies [1].

This methodology paper describes a rehabilitation programme designed as part of an ongoing controlled clinical trial on the efficacy of multidisciplinary brain injury rehabilitation for moderately head injured active duty military service members. The randomized, controlled study compared the efficacy of a home rehabilitation to that of TBI cognitive rehabilitation as outlined below. The study was approved by the Walter Reed Army Medical Centre Clinical Investigation Committee and the Human Use Committee as work unit number 7144. The participants were active duty soldiers with moderate traumatic brain injury within 90 days of enrolment. Inclusion criteria were post-traumatic amnesia of greater than 24 hours or intracranial lesions on MRI, a Rancho Los Amigos cognitive level of at least 7, and signed volunteer consent. Exclusion criteria were co-morbid physical injuries that would independently exclude successful return to duty.

Patient characteristics

Demographic and outcome data on the 67 protocol eligibile patients who completed the 8 week treatment programme to date are described in table 1. Sixty-four (96%) of the patients were male, and 24% were African American. The mean age was 24.7 years, and 32% were married. Most patients were high school graduates (61%) without additional education and were of junior enlisted rank (72%). Fourteen non-commissioned officers and five commissioned officiers were treated. Thirty-one per cent of the traumatic brain injuries were alcohol related accidents, and 21% were attributed to assaults. At 1 year follow-up, 64 of the patients (95.5%) were able to work or were enrolled in college. Sixty-six per cent of the patients (44) remained on active duty or remained fit for duty, but were discharged from the military for non-medical reasons.

Inpatient rehabilitation programme

The inpatient treatment programme included protocol patients randomized to it as well as other brain injured active duty patients, who did not meet protocol inclusion criteria but had similar cognitive deficits and potential for return to duty.

The primary goal of the rehabilitation programme was to successfully return the patients to active duty. As such, it was based on a combination of literature-supported recommendations and a practical framework guided by military rules and regulations.

The interdisciplinary programme combined group and individual therapies within an inpatient milieu-oriented neuropsychological focus similar to that described by Prigatano *et al.* [2]. The cornerstone of the Prigatano model includes the functioning milieu, an environment 'in which the therapists and patients meet to discuss a day's events, provide positive feedback for successful accomplishments, and gently [but directly] confront any behaviour of patient or staff that interferes with patients' progress towards independence or the capacity to work' [3]. An integrated work-based treatment intervention modified from the models described

Table 1. Demographic and outcome data on 67 patients with one year follow-up who completed the 8 week treatment programme. Initial Glascow Coma Score was available on 23 of the 67 patients
Patient characteristics and outcome, total n = *67*

Variable	*n*	Per cent
Gender (% male)	64	96
Race		
Caucasian	46	69
African American	16	24
Other	5	7
Age (mean = 24.6)		
Married	22	33
Military rank		
Junior Enlisted	48	72
Non-commissioned Officer	14	21
Commissioned Officer	5	7
Education		
High School Graduate	41	61
Some College	19	28
College Graduate	5	8
Post Graduate	2	3
Branch of Service		
Army	53	79
Navy	8	12
Air Force	5	8
Marine Corps	1	1
Loss of consciousness	48	73
(Mean duration = 35 hours)		
Post traumatic amnesia	64	96
Duration > 5 days	33	49
(Mean duration = 7.2 days)		
Initial Glascow Coma Score	23	35
Mean = 9.7 (available data)		
Alcohol related injury	20	31
Assault related injury	14	22
Return to work at 1 year follow-up	64	96
Fitness for duty at 1 year follow-up	44	66

by Ben-Yishay *et al.* [4] and Burke *et al.* [5] was also included. These models incorporate several hours of goal oriented employment type work tasks in the daily therapy schedule. Mazmanian *et al.* [6] found that only 19% of surveyed cognitive TBI programmes use this combination of group and individual therapies, while 66% of the programme consisted of only individual therapies. However, effectiveness and outcomes were not measured.

Since the programme was geared toward returning soldiers to duty, most of the scheduled activities, homework assignments, and living environment used within the programme were modified in some way to make them relevant to the military. The patients were hospitalized in a minimum nursing care setting because of the lack of appropriate military style barracks. Otherwise, the treatment programme could easily have been accomplished in an outpatient setting with supervised housing.

The 8 week treatment length was chosen in order to balance the patient's treatment needs with the military's need to have soldiers return to their posts within

a reasonable period of time. Uniform wear was encouraged, and the group therapy sessions were run in a classroom setting to simulate the training type work environment common in military schools. Timely attendance and participation in this voluntary programme were encouraged with a reward system of progressive unsupervised independence during 'non-duty' (non-therapy) times. Patients were initially restricted to the ward and/or hospital grounds. As they earned points for timely attendance and participation, the patients were awarded unsupervised overnight and weekend passes away from the hospital.

The rehabilitation team was comprised of active duty and civilian personnel. An active duty physiatrist directed the team. A neurologist served as the attending physician on the ward, and a dedicated rehabilitation nurse guided the nursing care. A neuropsychologist, an occupational therapist, two half-time speech and language pathologists, and two rehabilitation assistants completed the treatment team. The rehabilitation assistants held bachelor degrees and had an interest in clinical rehabilitation. They conducted certain pre-planned therapy activities under the supervision of the occupational therapist or speech and language pathologist; they also served as support staff for all of the treatment team clinicians. Physical therapy and psychiatry were provided on a consultation basis as needed.

The entire team met at least weekly to discuss programme issues and patients' goals and plans, facilitating an interdisciplinary approach to patient care. Therapists and the rehabilitation assistants were cross-trained to cover for each other in the event of illness or leave.

The daily schedule began at 0645 with a fitness group designed to prepare the soldiers for the physical fitness requirements of active duty. The rehabilitation assistants, under the supervision of the physiatrist, led the group. The standards of the Army Physical Fitness Tests were used to monitor improvement throughout the 8 week programme [7]. Patients with physical limitations due to co-morbid injuries were provided with appropriate physical therapies or alternate physical activities as indicated.

The overall treatment programme's daily schedule is demonstrated in table 2. The group therapy and individual treatment sessions are described below, along with the scientific basis for their programming.

The morning sessions consisted largely of group therapies including fitness group, planning and organization group, cognitive skills group, and milieu group. Individual therapy sessions occurred from 1100 to 1200 hours with additional time as needed. Work therapy, the psychotherapy group, the work skills group and the medication group all occurred in the afternoon. All sessions were required for programme participants. Goal setting was done on an individual basis. Skill acquisition in a structured therapy setting is only effective if those acquired skills are generalized to the working and living environments of each individual soldier. Therefore, goal attainment was examined within a number of functional environments. Activities were integrated across therapists and treatment groups. For example, a therapeutic outing was planned in a cognitive skills group, evaluated afterwards during a psychotherapy group, and written about in the form of after-action reports during individual speech therapy sessions. Where possible, military relevance was maintained in the group and individual activities regardless of the cognitive process addressed.

The programme was designed to permit patients time to recover from their injuries, to learn new compensatory skills, and to assist them in dealing with the

Table 2. Weekly schedule for traumatic brain injury inpatient cognitive rehabilitation programme. Individual therapies rotate among Speech and Language Pathology, Occupational Therapy, and Neuropsychology

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
0645–0745	Fitness group	Fitness group	Fitness group	Fitness group	Fitness group
0745–0850	ADL's	ADL's	ADL's	ADL's	ADL's
0850–1030	Cognitive skills group	Cognitive skills group	0850–0925 Individual therapy 0940–1030 Pragmatics	Cognitive Skills group	Cognitive Skills group
1035–1100	Milieu group	Free time	Milieu group	Substance awareness	Milieu group
1110–1200	Individual therapy: Speech, OT, or Neuropsych	Individual therapy	Individual therapy	Individual therapy	Free time
1200–1330	Lunch	Lunch	Psychology Lunch	Lunch	Lunch
1330–1530	Work therapy	Work therapy	Work therapy	Work therapy	1300–1430 Work Skills group (OT)
1600–1700	Medication group	Free time	Free time	Free time	Free time

emotional after-effects of their losses. It allowed them to attempt new behaviours, strategies, or responses in a supportive, cooperative, and intellectually inventive environment.

Group therapies

The programme followed a cognitive paradigm that identifies seven cognitive skill areas: orientation, attention, memory, visual processing, language, executive functioning, and abstract reasoning/problem-solving. The ability to engage in higher level skills is partially dependent on the mastery of basic cognitive domains, such as orientation and attention. Therefore, it is important to consider the contributions of deficits in areas like attention to functional problems observed in higher level skills such as abstract reasoning.

Planning and Organization group

The Planning and Organization group was initially conceived of as 'an advanced organizer, building a proactive memory'. The purpose was to assist with organizing patient schedules, reinforcing acquired skills from other groups, such as the use of mnemonic devices, and reiterating patient treatment goals as needed. Once it became apparent that a group focusing only on scheduling was not needed for the majority of the patients, the group expanded to address other aspects of executive functioning. Deficits in executive functioning areas: setting goals; planning, organizing, initiating, monitoring, and completing tasks; and time management are often noted in the mild to moderate brain-injured population. These may exist in the absence of other cognitive deficits, such as abstract reasoning, problem

solving, and memory. The therapeutic activities presented in the Planning and Organization group were designed to ameliorate or assist in the compensation of these impairments.

The group met four times per week for 30–40 minute sessions and was held within the cognitive skills schedule block (table 2). This group was typically co-led by an Occupational Therapist and a Speech-Language Pathologist, sometimes with the aid of a Rehabilitation Assistant. Types of tasks presented in this group included short term and long term personal goal setting, activity/outing planning, group meal planning, organizing schedules, and self-evalution. Periodically, comprehensive group projects extending over several days were assigned to patients in order to provide challenges to assist individual skill acquisition as well as emphasize the importance of utilizing strengths within the context of a group.

Individual goals achieved within a group task as well as interpersonal interactions and roles within the group were observed. Upon completion of these extended projects, the patients and staff carried out evaluations of individual and group performance. Videotaping provided an effective means for staff to assess overall performance, as well as to assist group members in self-monitoring skills and goal setting.

Cognbitive Skills group

Another group co-led by Occupational Therapy and Speech-Language Pathology was the Cognitive Skills group. It met three to four times a week for 50 minute sessions. This group was designed to teach problem-solving strategies and to provide the opportunity to practice these strategies in varied and novel situations. While the Planning and Organization groups target executive functioning skills, the Cognitive Skills group focuses on attention, memory, problem-solving, and abstract reasoning. This group primarily followed a process-specific approach, as outlined by Sohlberg and Mateer [8], targeting specific cognitive skills for both remediation and compensation.

Memory intervention focused on compensatory strategies to assist with more effective and efficient encoding, storage, and retrieval of new information. An emphasis was placed on the patients' ability to identify the techniques that are most effective for them and to utilize strengths to compensate for memory deficits. Both internal strategies (e.g. rehearsal, association) and external devices (e.g. memory notebooks, electronic organizers) were used.

Problem-solving components included identification of the problem, brainstorming of possible solutions, prediction of potential effects of different plans, evaluation and prioritization of solutions, and implementation of solutions. Compensatory strategies were stressed as needed. In addition, as real-life situations arose, patients were assisted in using these strategies and critical thinking skills to tackle their personal problems in a systematic and logical fashion. Problem solving and abstract reasoning activities ranged from skill-specific tasks to more comprehensive projects with both individual and group problem-solving activities.

Pragmatics group

In addition to cognitive deficits, many brain-injured patients exhibit pragmatic deficits. Pragmatics involves the rules that govern language use in different situations

and social contexts. This includes non-verbal communication, initiation of conversation, turn-taking, staying on topic, ability to ask for clarification, ability to revise communication when the listener does not understand, verbosity, reduced verbal organization, and reduced sociolinguistic sensitivity. Pragmatic issues were so prevalent in this patient population that a separate Pragmatics group was established in order to address them.

This group met once a week for 1 hour and was led by two speech-language pathologists. Its primary aims were to improve problem solving and decision-making in various communication settings, as well as to increase patients' understanding and awareness of their interaction in different contexts. Group interaction was a good tool for demonstrating a firm understanding of the concept of pragmatics. Specific goals and tasks were dependent on specific needs and deficits of the group member.

Approaches utilized specific tasks that take place within a single group session or comprehensive tasks that extended over more than one session. Some activities were designed to address multiple pragmatic skills. For example, patients prepared speeches and debates in order to focus on different areas such as eye contact, verbal organization, turn taking, and topic initiation and maintenance. Another comprehensive project was a job interview activity, requiring patients to write a job description for a hypothetical position, plan interview questions, conduct mock interviews, and evaluate strengths and weaknesses of job candidates.

The skills acquired in the context of this high level cognitive session were monitored throughout other therapeutic contexts, including individual treatment sessions and vocational settings. The functional activities selected were designed to help patients transfer skills and increase their rate of success. TBI patients will often demonstrate normal behaviour on isolated skills or structured tasks, but exhibit a noted breakdown in performance when presented with less structured, more comprehensive tasks.

Milieu

Three times each week the patients and entire staff met for a $\frac{1}{2}$ hour organizational and planning session, the Milieu. These sessions provided an opportunity for a regular discussion of emerging or ongoing rehabilitation issues, remainders regarding ongoing or upcoming events, a chance for closure of recently completed activities, and a regular opportunity to reinforce patients' individual therapeutic goals.

The Milieu sessions were nominally led by the programme director or his designee, although this was probably the least structured and most problem- (rather than process-) centred of the week's activities. This was the TBI rehabilitation programme's planning and business meeting, and any event relevant to the smooth running of the rehabilitation programme and the satisfaction of its participants was considered 'grist for the mill'. It was the goal of the rehabilitaton team to defer as few solvable problems as possible, rapidly developing solutions, reaching consensus, agreeing to actions, and evaluating results in real time. Issues with wider-reaching psychological, cognitive, or therapeutic implications were deferred to the appropriate individual or group activity; patients were encouraged to 'bring it up in Milieu' when the issue was of broader interest or immediate effect.

Community re-entry outings

Every other week, patients went on a several hour-long community outing. Patients planned the specific activity from deciding on a destination and identifying transportation needs, to estimating activity time, costs involved, and any other considerations. Typically, patients were accompanied by one or two staff member—rehabilitation assistants, an occupational therapist, or a speech-language pathologist.

These outings allowed patients to work on executive functioning and community problem-solving skills in a more natural context. Staff had an opportunity to observe how patients navigated a new transportation system, followed directions and figured out routes, coped with multiple stimuli (e.g. crowds, noise, unfamiliar settings), etc. Individual assignments related to the activity facilitated learning and reinforced cognitive stills addressed in other groups.

Group psychotherapy

A twice-weekly group provided a psychotherapeutic milieu to facilitate and improve patients' coping with the consequences of TBI. The group was led by a clinical neuropsychologist, and was periodically co-led by a psychology intern or psychiatry resident. Its focus was on emotional and motivational changes associated with brain injury. The 8-week, 16 session cycle began with a 'primer' on the physical, cognitive, and emotional effects of TBI, with efforts to make this didactic portion of the group experience relevant to the circumstances of each patient's injuries and their own particular deficits. Throughout, patients were encouraged to emphasize feelings and reactions to their injuries, rather than simply to restate the physical effects or practical constraints of their accidents. In accordance with the goals of psychotherapy provided by Prigatano *et al.* [2], the DVHIP inpatient psychotherapy group was intended to:

(1) provide a model to help the patient understand what has happened to him;
(2) help the patient deal with the meaning of the brain injury in his life;
(3) help the patient achieve a sense of self-acceptance and forgiveness for himself or for others who may have caused the accident or injury;
(4) help the patient make realistic appraisals of current competencies and make appropriate commitments to return to their social and vocational situations;
(5) teach the patient to behave in different social situations, and provide an opportunity to model appropriate prosocial behaviours;
(6) where appropriate, provide specific behavioural strategies for compensating for residual emotional or interpersonal difficulties; and
(7) foster a sense of realistic hope.

Medication group

All patients attended a 45 minute weekly medication group, whether or not they were taking prescription medications. A master's level psychiatric nurse experienced in TBI, in consultation with a board-certified psychiatrist, facilitated the group. The group allowed ongoing assessment of possible disturbances of sleep, mood, anxiety, or attention amenable to pharmacological intervention. Patients had the opportunity to report and discuss medication issues, side effects, and plans for follow-up after discharge. The psychiatric nurse offered feedback to the treatment team regarding each patient. Individual appointments were available for patients to discuss

any issues they prefered not to share in the group. Importantly, the group provided an additional opportunity to monitor the mental health of the participants.

Individual therapies

Individual speech therapy

Each patient participating in the TBI programme received individual speech-language therapy twice a week for 50 minute sessions. The speech-language pathologist or, at times, a rehabilitation assistant under the direction of the speech-language pathologist, led the speech therapy sessions. Here, as in individual occupational therapy, activities addressed the individual goals of the patient. One priority of these sessions was to focus on specific speech-language deficits that may not have been addressed in the treatment groups described above, such as dysarthria, stuttering, and mild aphasia. In addition, patients worked on other cognitive-linguistic deficits, such as memory, reasoning, and executive functioning, with tasks tailored to the patient's specific deficits and difficulty level.

Individual occupational therapy

All patients received one or two 50 minute individualized occupational therapy sessions each week. These sessions promoted independence in daily tasks identified within the patient's occupational role performance areas. The treatment concentrated on specific cognitive skills within the context of a functional activity.

Participants typically required remediation of higher level activities of daily living, such as money management, community level problem solving, time management, and vocational activities.

Therapists discussed standardized testing results with the patient and compared deficit areas with the patient's reported concerns. Together, the patient and therapist identified the main areas of concern, set goals, and established a treatment plan.

Supervision levels during a therapy session varied, based on differing levels of independence. A patient's individual therapy session may have been 1–1 with the therapist, 1–1 with a rehabilitation assistant for set up and cueing, or may have entailed independent work on a task or long term project. Real life personal issues such as possible military pay difficulties, legal ramifications of the accident, and home finance problems provide ample fodder for evaluating cognitive skills and executive functioning. They also allowed for problem resolution under the appropriate level of supervision, structure, and cueing.

Work therapy

The work therapy portion of the TBI programme was coordinated, assessed, and documented by the occupational therapist and was designed to meet various needs. These included work performance assessment before return to a competitive work environment, recommendations regarding work potential, and remediation of deficits in work skills. Most importantly, it facilitated the patients' return to duty by conditioning them to a work environment.

Work therapy goals were established with the patient in the first week. Patients were placed in job sites that were as closely related as possible to their military occupational speciality (MOS). The work therapy goals directed the placement site when infantry and field type jobs were not available in the hospital/military post environment. The work therapy site supervisor provided feedback on patient performance and progress towards these goals. Patients also provided feedback and completed a work therapy journal. The therapist gauged the patients' insight into their performance and adjusted goals as necessary to insure that work skill deficits were addressed and that the level of challenge provided was within a therapeutic range.

Patients often viewed work therapy as a forum for demonstrating their capabilities. Maintenance of military bearing was stressed, as well as professional responsibility and communication. The patient role was left behind, and the soldiers regained their worker identity and the self-confidence neded to return to duty. Work therapy served as the functional environment where patients practiced those executive functioning skills acquired during the daily group and individual therapy sessions.

Work therapy took place Monday–Thursday for 2–3 hours each afternoon. Work placements were investigated as a joint effort of the occupational therapist and a rehabilitation assistant. The rehabilitation assistant made random work checks to ensure attendance and monitor work performance. Problems with work therapy placements or patients satisfaction with the work assignments were discussed during milieu group, the work skills group, or during individual occupational therapy sessions.

Disposition

Protocol patients were enrolled into the programme after randomization or on a space available basis if not protocol eligible. Non-protocol eligible patients were not admitted to the programme if the group census was six or greater. All patients received a standardized test battery consisting of MRI, EEG, neuropsychologic, psychiatric, neurologic, speech/language, and occupational therapy evaluations. Results helped establish goals for each patient. Rehabilitation assistants oriented new patients on Tuesday mornings. The entire staff met with each new patient following the orientation to answer questions and emphasize the interdisciplinary nature of the treatment programme. Patient group enrollment ranged from one to seven patients at any given time. Additional individual treatment sessions took the place of group therapies when patient enrolment dropped below three.

Upon completion of the 8 week rehabilitation programme, patients underwent a follow-up battery of cognitive testing. The soldiers were then returned to their units for a 6-month trial of duty unless there was a clear indication from the testing results and rehabilitation programme performance that a given patient was not able to return to work. In that case, the patient was offered additional therapy based on the recommendations of the treatment team and a medical separation procedure was initiated. Soldiers who are medically retired received additional services through the Department of Defense, Department of Veterans Affairs, or civilian health care systems. All patients continued to be evaluated at 6, 12 and 24 months

after protocol accession and may have undergone a medical separation evaluation at any time.

Conclusion

Prior to the establishment of the DVHIP, active duty soldiers returned to duty after a TBI only if they were able to perform their jobs immediately following a short convalescent period. Treatment opportunities with a goal of timely return to duty were rare. The rehabilitation programme described above demonstrates one successful effort to rehabilitate soldiers with TBI who have the potential to return to duty.

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