Exploring Patient Engagement: A Service Evaluation on Use of Rehacom in Conjunction with Conventional Cognitive Rehabilitation in Acquired Brain Injury Patients at University Hospitals of Leicester

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ABSTRACT

Background: Acquired Brain Injuries (ABIs) significantly impact cognitive function, emotional regulation, and daily living activities, posing a substantial burden on individuals and the healthcare system. Cognitive Rehabilitation (CR) aims to address these impairments, with Computer-Assisted Cognitive Rehabilitation (CACR) tools like RehaCom emerging as promising interventions. **Objective:** This study evaluates adherence to RehaCom in a Neurorehabilitation inpatient setting, exploring patient engagement, barriers to participation, and potential benefits when integrated with conventional CR. **Methods:** A Service Evaluation was conducted at a UK Neurorehabilitation Unit (NRU) involving 27 patients with ABI, aged 20–80 years, and a Montreal Cognitive Assessment (MoCA) score of <26. Participants completed weekly RehaCom sessions alongside traditional CR over five weeks after completing RehaCom screening. Adherence was assessed through screening completion, session attendance, engagement duration, and patient-reported outcomes. **Results:** Of the 27 participants, 22.2% were unable to complete the RehaCom screening due to agitation, cognitive deficits leading to non-completion of task or challenges with computer controls. An additional 22.2% engaged in sessions but failed to meet the minimum engagement threshold of 15 minutes. Only 29.6% completed all five weekly sessions, with higher MoCA scores correlating with better adherence. Three main barriers for variable adherence to RehaCom use were cognitive impairment, fatigue and patient preferences for conventional therapy. **Conclusion:** RehaCom shows promise as a CR tool, but its detailed screening and task complexity may hinder engagement in patients with significant cognitive challenges. Higher MoCA scores predict better adherence, indicating its targeted utility for certain patient subgroups. Future research should explore modifications to enhance usability, integrate education about its benefits, and evaluate long-term outcomes in diverse populations.

KEYWORDS- Cognitive Rehabilitation, MoCA, Computer assisted Cognitive Rehabilitation , RehCom

INTRODUCTION

In the UK, brain injuries are a significant health concern. According to Headway UK, a Brain injury charity association, approximately 350,000 people are admitted to hospitals each year with Acquired Brain Injuries(ABI). These injuries can result from various causes, including trauma, strokes, tumors, infections, and other medical conditions.(1) ABI can lead to severe impairments that affect cognitive function, emotional regulation, and daily living activities, resulting in a substantial burden on individuals and the healthcare system. As the prevalence of ABI continues to rise, effective interventions for Cognitive Rehabilitation(CR) have become increasingly essential.

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CR was initiated for patients with brain injuries during World War I to improve survival outcomes.(2) Since then, researchers have developed various CR techniques and models aimed at addressing impairments in cognitive functions such as memory, attention, language, and executive functioning. CR is often a crucial component of the recovery process for individuals with brain injuries. Its integration into rehabilitation programs for individuals with brain injuries admitted to Neurorehabilitation units in the UK reflects a growing understanding of the need for targeted therapeutic interventions that facilitate cognitive recovery.(3,4) The recent study by Julien et al provided a comprehensive evaluation of the effectiveness of CR in improving cognitive outcomes for patients with moderate to severe traumatic brain injury (TBI).(5)

CR techniques are generally categorized into two main types: conventional methods and Computer-assisted Cognitive Rehabilitation(CACR). Conventional CR for cognitive impairment in a Neurorehabilitation setting typically involves a series of non-computerized activities designed to stimulate various affected cognitive domains, including attention, memory, visual field defects and executive function. The most prevalent approaches in CR focus on teaching compensatory strategies to mitigate the functional impact of cognitive impairments. (6,7)Alternatively, some approaches aim to restore impaired functions through repetitive exercises or massed practice of specific tasks. The repetitive presentation of stimuli and the execution of responses can trigger neural plasticity processes that support cognitive recovery.(8,9)

CACR uses personal to utilize multimedia and software systems for enhancing cognitive functions, including attention, memory, problem-solving, language, and executive functions. Recent studies on CACR for brain injury patients, including those with TBI, stroke, and post-concussion syndrome (PCS), have shown promising results in enhancing cognitive recovery. CACR programs have been found to improve various cognitive functions such as attention, memory, processing speed, and executive functions in various studies.(5,10-12) A recent systemic review was also done which assessed various software and devices used for cognitive training in neurological patients. The study highlighted that these programs have shown positive outcomes in improving cognitive functions in individuals with neurological impairments, including those with brain injuries. (13)The interactive and adaptive nature of CACR tools increases patient engagement and motivation, leading to better adherence to rehabilitation programs. Additionally, these systems allow for the modification of task type, duration, and difficulty, enabling interventions to be tailored to individual abilities. Tasks are organized by the cognitive domain being stimulated, and the difficulty is adjusted to prevent patient frustration due to tasks that are either overly challenging or simplistic.(14)

RehaCom (HASOMED GmbH, Magdeburg, Germany, 1997) is a highly advanced software system designed for CACR. It is a versatile tool which has comprehensive features that facilitates the rehabilitation process and helps individuals improve their cognitive functioning. Previous studies have demonstrated that RehaCom improves several cognitive domains, including verbal response, working memory, and processing speed among patients diagnosed with various conditions such as stroke, ABI and multiple sclerosis.(15-16).

While numerous studies have reported positive outcomes with RehaCom in cognitive rehabilitation, some research has not demonstrated similar significant improvement in activities of daily living.(17-19) These findings suggest that the efficacy of RehaCom may vary depending on the specific cognitive domains targeted and the patient populations involved.

The design of Rehacom sessions for neuropsychological intervention is customized to align with each patient's tolerance levels; however, session duration was often determined by the patient's level of engagement. To boost processing speed, participants are engaged in timed tasks that required quick responses to prompts. Visual-spatial skills were developed through navigation exercises in virtual environments and organization tasks, while daily living skills were practiced through realistic scenarios, such as meal preparation and financial management. Additionally, exercises targeting neglect helped patients attend to both sides of their visual field by scanning text or locating objects in cluttered environments. Collectively, these activities aim to promote greater independence and improve the overall quality of life for patients.(20-22)

However, there are limited reports on its incorporation with conventional CR in inpatient rehabilitation services in ABI patients.

This study seeks to assess the level of adherence to Rehacom usage among individuals with cognitive impairment in our Neurorehabilitation unit, within the context of our CR regimen. By investigating the interaction between cognitive impairments and RehaCom participation, we aim to understand how this computerized tool can complement traditional rehabilitation efforts and identify patient groups that may benefit the most from its implementation in an inpatient setting.

METHODOLOGY

Ethics

As this is a service evaluation, formal ethical approval was not required; however, the study adhered to core ethical principles regarding patient confidentiality and informed consent for data collection. This service evaluation was registered with the institutional Quality Improvement (QI) regulatory team and adhered to local institutional regulations regarding the review of patient records and the collection of data.

Verbal consent was obtained for the use of Rehacom from patients. Written informed consent was not required for participation in this study, as per national legislation and institutional requirements. This is in line with the guidelines for service evaluations, where the aim is not to introduce experimental interventions but rather assess existing practices and outcomes.

Setting

The study was conducted at the Neuro Rehabilitation Unit (NRU), a tertiary-level Neurorehabilitation facility located in Leicester,UK. NRU accepts patients from acute Neurosurgical, Neurology, and Acute medical wards in the region. The unit holds Level 2a status within the United Kingdom Rehabilitation Outcomes Collaborative (UKROC), signifying its capacity to provide rehabilitation for patients with highly complex needs that exceed the scope of local and district specialist services.

The multidisciplinary team (MDT) in NRU includes Rehabilitation medicine physicians, physiotherapists, speech and language therapists, occupational therapists, Rehabilitation nurses, neuropsychologists, support workers, and a social worker. Patients admitted to NRU receive daily rehabilitation through a combination of CR sessions and other therapeutic activities. The CR sessions primarily consist of cognitive stimulation therapy (CST) activities, involving tasks like card games, memory exercises, participation in daily activity groups (such as a breakfast club), recreational activities, and pen-and-paper tasks. These sessions are integrated with practice of other activities of daily living like washing and dressing performed with or without assistance, to maximize functional independence.

Study Design

This study employed an approach to systematically explore patient engagement with the RehaCom software when used alongside traditional CR interventions. Data was collected at the individual patient level to assess the potential benefits of integrating Rehacom into inpatient neurorehabilitation. The study design does not employ experimental tools, nor does it include a control group. Instead, it focuses on assessing the real-world implementation and engagement of patients with the Rehacom software as part of their rehabilitation.

Participants

Eligible participants were patients aged between 20 and 80 years, with a Montreal Cognitive Assessment (MoCA) score of less than 26, indicating cognitive impairment. The MoCA is a widely used screening tool for global cognitive function. MoCA is widely recognized and utilized in clinical settings for cognitive screening, including in patients with acquired brain injuries (ABIs). Its effectiveness in identifying cognitive deficits, monitoring recovery, and guiding rehabilitation efforts has been well established in various studies.(23,24)

Exclusion Criteria

Patients were excluded if they met any of the following criteria: Illiteracy or lack of basic computer skills (as these would limit engagement with the Rehacom software), Receptive aphasia, significant cognitive communication difficulties, or reduced visual acuity, Degenerative progressive neurological diseases or a premorbid history of cognitive impairment that could confound the results related to ABI. These criteria were designed to focus specifically on cognitive impairments resulting from ABI, eliminating factors that could potentially affect the outcomes of the evaluation. This was assessed as part of initial admission screening in NRU.

RehaCom Sessions

The intervention involved the use of the RehaCom software and was delivered through a custom keyboard on a portable computer. The senior occupational therapist in the Neurorehabilitation team, who had received initial training on RehaCom from the manufacturers, was responsible for conducting the MoCA screening, RehaCom screening, and overseeing the intervention sessions.

The RehaCom sessions were explained verbally to patients, who were informed that participation was voluntary and that their personal details would remain anonymous. Based on the outcomes of the MoCA Scores and RehaCom cognitive screening, a combination of conventional CR sessions and weekly RehaCom intervention sessions was tailored to each patient until their discharge.

The software offered exercises based on activities of daily living, designed to enhance cognitive functions essential for independent living. These activities targeted areas such as Attention and concentration (e.g., sorting items, completing puzzles),Memory enhancement (e.g., recalling grocery lists, using calendars),Visual-spatial skills (eg. Labyrinth maze,topological memory),Processing speed(eg.Sorting task,divided attention), Neglect or Visual field Defect(eg hidden object exploration)

The system dynamically adjusted the level of difficulty based on each patient's performance, calculating results such as reaction time, accuracy, and the number of errors. The RehaCom software also generated individual results, which were used to tailor future sessions. The intervention was considered successful if the patient was able to engage with the system for more than 15 minutes per session. The RehaCom catalog suggests that at the beginning of cognitive therapy, training several times a day for about 10–15 minutes is recommended.(25) In addition, studies on similar technology-based CR programs, such as virtual reality or computerized cognitive training, suggest that 15–20 minutes of activity is an effective minimum for initial engagement and cognitive improvements, particularly in the early stages of rehabilitation (26,27)

Each patient participated in one RehaCom session per week for first 5 weeks of admission, replacing one weekly conventional CR occupational therapy session. It was integrated into a broader rehabilitation schedule that included three physiotherapy sessions, one occupational therapy sessions focused on conventional rehabilitation activities along with practice of daily activities of living (e.g., washing, dressing, kitchen tasks),breakfast club session to promote social interaction and functional skills, two weekly neuropsychology review sessions to assess and address cognitive impairments. These therapy sessions typically lasted one hour, unless the patient opted to finish earlier. No more than two sessions were scheduled per day, to avoid cognitive fatigue. This routine was consistent across all patients admitted to the NRU.

Adherence to Rehacom

Patient adherence to RehaCom was assessed through: Patient demographic and clinical characteristics (e.g., age, gender, type and severity of brain injury, MoCA score), Completion of the RehaCom screening, Completion of weekly RehaCom session for 5 weeks of inpatient stay, Duration of each completed RehaCom session, Observations related to patient satisfaction, engagement barriers, and motivation during RehaCom sessions, For safety reasons, any instances of fatigue, headaches, or dizziness following RehaCom sessions were carefully documented and reviewed.

RESULTS

Use of Service

A total of 122 patients were admitted to the NRU between October 2021 and October 2023. Of these, 27 met the inclusion criteria for this study and provided verbal consent to participate in a trial of RehaCom, alongside their routine therapy sessions. The demographic details of these patients are summarized in Table 1. MoCA Score and RehaCom Intervention Participation. All 27 patients successfully completed the MoCA screening. The MoCA scores ranged from 12 to 24, with a mean of 19 (SD 3.06). Figure 1.shows a pie chart depicting the completion of RehaCom Screening in the 27 patients included in this study.

Patient Characteristics	
Number of Patients(n)	27
Mean Age (Years) (SD)	53.3 (34.4)
Length of Stay (LOS) in NRU (Days)(SD)	51 (21.1)
Sex	Male: 63% (n= 17) Female: 37% (n= 10)
Type of Neurological Insult	
Subarachnoid Haemorrhage	7
Hypoxic Brain Injury	2
Traumatic Brain Injury	9
Hypertensive Bleed	2
Ischaemic Stroke	1
Space Occupying Lesion	4

Table 1.Patient Characterstics.

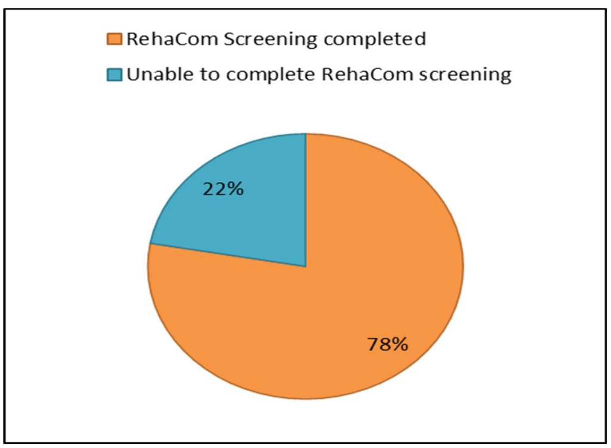

Fig 1.Pie Chart depicting RehaCom screening completion for the included patients.

The participation of the patients in screening and RehaCom intervention sessions is depicted in Figure 2.

6 out of 27 (22.2%) patients were unable to complete the RehaCom cognitive screening due to agitation, reduced attention and insight or difficulties using computer controls due to cognitive difficulties .An additional 22.2% patients, despite completing the screening, could not engage for a minimum of 15 minutes in RehaCom sessions, primarily due to cognitive impairments or fatigue. Furthermore, 7 patients (25.9%) engaged in fewer than 5 weekly sessions, with reasons including perceived simplicity of exercises, cognitive deficits , and discharge before study completion. one patient completed the first session but found it tiring due to cognitive fatigue, while 8 patients (29.6%) successfully completed all 5 weekly sessions. Table 2.shows the reasons of variable participation with RehaCom sessions in detail.

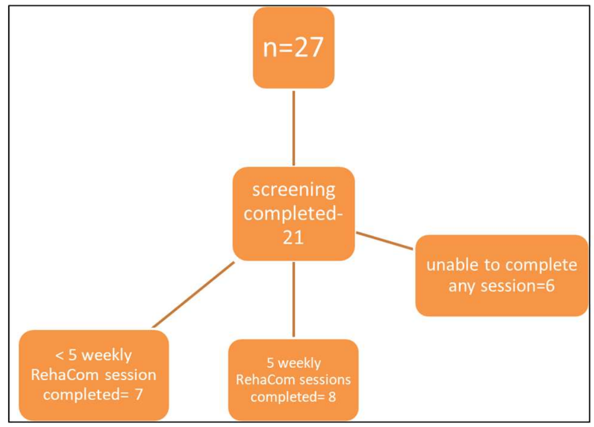

Fig 2.The participation of patients in RehaCom screening and intervention sessions.

Interestingly there was better engagement noted in patients with higher MoCA score as depicted on the scatter plot in Figure 3.

DISCUSSION

The study revealed mixed results regarding adherence to RehaCom use during the initial five weeks of inpatient rehabilitation. Fewer than one-third of patients completed all scheduled weekly sessions. While some patients consistently engaged with the intervention, many faced challenges that hindered their participation. A significant number of patients were unable to complete the RehaCom cognitive screening, which prevented them from progressing to the intervention sessions. These barriers were often associated with difficulties in cognitive and emotional regulation. Interestingly, these same patients successfully completed the MoCA screening, suggesting that traditional cognitive screening methods may be more appropriate for this population. The detailed and time-intensive nature of the RehaCom screening may have contributed to disengagement, making it less suitable for certain individuals.

Number of Patients	n=27	Percentage(%)
Patients unable to complete RehaCom cognitive screening	**6**	22.2%
1.Agitated during the screening	1	3.7%
2.Unable to engage fully due to reduced attention and insight	3	11.1%
3.Unable to use computer controls as per instructions due to cognitive deficits.	2	7.4%
Patients unable to engage for minimum 15 minutes in RehaCom sessions despite completing screening.	**6**	22.2%
1.Difficulty with RehaCom subprograms due to cognitive impairments	4	14.8%
2.Cognitive Fatigue during first session and did not continue	2	7.4%
Patients who engaged in <5 weekly sessions	7	25.9%
1.Perceived exercises as overly simplistic and preference for conventional therapy sessions	3	11.1%
2.Unable to complete consecutive sessions due to cognitive deficits.	2	7.4%
3.Discharged before completion of study	1	3.7%
Patients who completed first session and found it tiring due to	**1**	3.7%

Table 2. Various reasons for completion of variable number of RehaCom sessions.

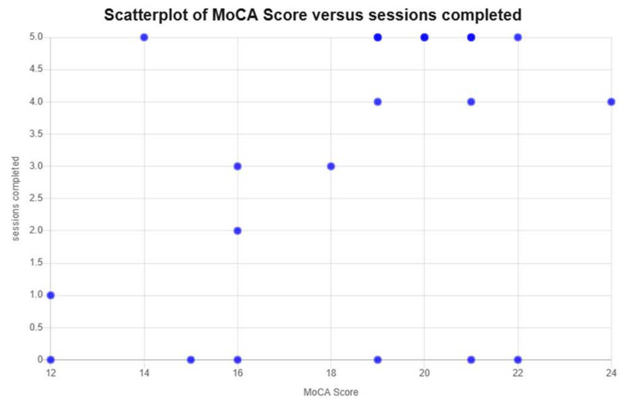

Fig.3. Scatter plot comparing MoCA score with completed RehaCom intervention sessions.

Three primary factors contributing to poor engagement identified were cognitive deficits that limited session completion, patient's perception of usefulness of RehaCom compared to conventional therapy, and cognitive fatigue. The session duration ranged from 15 to 60 minutes amongst patients who successfully completed all five weekly sessions. Importantly, patients with higher MoCA scores demonstrated better engagement with the intervention, this could guide the targeted use of this CACR tool, helping identify patient groups most likely to adhere to RehaCom use in inpatient setting.

These findings emphasize the need for refinements in use of CACR to better accommodate the diverse needs of patients. Educating patients about the value of innovative CR methods like RehaCom could improve adherence and facilitate better neurorehabilitation outcomes when used in conjunction with conventional approaches as has been established in various studies.(9-18) However, the study's limitations must be acknowledged. The relatively small sample size limits generalizability, and reliance on self-reported data introduces potential biases. Furthermore, the focus on early intervention stages leaves the longer-term effects and sustained engagement unexamined.

Future research should address these limitations by including larger, more diverse populations and extended follow-up periods. It would also be valuable to investigate how different cognitive domains improve with RehaCom use and how these improvements impact functional outcomes in neurorehabilitation patients. Additionally, exploring whether adherence to RehaCom improves after a period of conventional rehabilitation could provide insights into optimizing the timing and integration of such innovative interventions in neurorehabilitation setting.

CONCLUSION

Cognitive Rehabilitation has become a crucial component in patients undergoing neurorehabilitation and CACR tools have have been proven to be useful in these patients.This study shows that while RehaCom use has potential in inpatient neurorehabilitation, many patients faced challenges that affected their engagement, particularly due to cognitive and emotional difficulties. Traditional screenings like the MoCA may be more effective in identifying suitable candidates for CACR tools like RehaCom. Key factors such as cognitive deficits, perceived usefulness, and cognitive fatigue influenced participation. Future research should refine RehaCom's use, educate patients on its benefits, and explore its long-term effects in larger sample size of participants to optimize its integration with conventional cognitive therapies.

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