

Review

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Review

Effectiveness of Function-Based Training on Cognitive Functions and Occupational Performance Among Post-Stroke Survivors: A Systematic Review Protocol

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Abstract: Background: Stroke survivors often face significant cognitive impairments that affect their occupational performance and quality of life. Traditional rehabilitation methods may not always address the specific cognitive deficits impacting daily activities. Function-based training, which integrates cognitive tasks with functional activities, has emerged as a potential approach to enhance cognitive functions and improve occupational performance. Methods: We adopted the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocol (PRISMA-P) guidelines when developing the protocol. The review protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO)(CRD42024563917). The search databases will include PubMed, MEDLINE, CINAHL Complete, EMBASE, ProQuest, and OT seeker, from 2014 to 2024. Discussion: Extensive research and practice of various interventions such as computerized cognitive retraining have been incorporated in current clinical practice. Limited reviews are focusing on function based cognitive training and the use of varied strategies in remediating cognitive functions and occupational performance. We, therefore, intend to compile, synthesize and appraise research articles that have evaluated function-based training among post-stroke survivors. This will enrich the knowledge base and evidence base in the field of cognitive rehabilitation, providing a guiding path to occupational therapists and researchers working among post-stroke survivors.

Keywords: occupational therapy; function based cognitive training; occupational performance; stroke

1. Introduction

Stroke is one of the leading causes of long-term disability worldwide, with its incidence increasing with age ¹. Post-stroke sequelae may present with varied negative effects on the performance of daily living activities, further affecting their ability to participate and be active, significantly reducing the quality of life ². Of the many deficits resulting from stroke, cognitive impairments are a common consequence of stroke and are seen to be reported in half of the patients over 6 months post-stroke, making a significant impact on the stroke survivor's functioning, limiting their ability to perform tasks and reducing the quality of life (QoL). Improvement of cognitive abilities post stroke is directly linked to improvement in the quality of life and functional independence (Mancuso et al., 2023). This is a primary concern that needs to be addressed ³. Post-stroke cognitive impairments range from mild to severe and their incidence is significantly high, occurring in up to 60% of the stroke population in the first year following stroke ⁴. It is seen that numerous domains of

cognition are affected, depending on the severity of the stroke. A high prevalence of cognitive impairments is commonly seen among stroke survivors, namely, attention, memory, language, perceptual-motor function, and executive function⁵. Attention and executive function impairments seem to be most prevalent and of greater severity following stroke, both short and long-term^{6,7}.

Post-stroke cognitive impairments are also often accompanied by difficulties in motivation, drive, and adjustment which predict poorer performance in instrumental activities of daily living (IADL)⁸. This wide range of multifaceted cognitive impairments commonly seen post-stroke mandates complex interventions and cognitive models that address this dynamic interaction of the person, environment, and occupation^{9,10}.

The ability to manage challenges in daily living tasks involves identifying and setting goals, overcoming problems and taking actions to problem solve all affecting one's ability to engage in meaningful occupations. This underpins the collective interaction between biological, psychological and social influences along with person, task and environment interactions¹¹. In the juncture of these interactions lies the concept of 'occupational performance', which is defined as the interaction of the individual with the environment while performing activities of choice that are essential and meaningful¹².

Occupational therapy is a unique profession that focuses on the use of meaningful and day to day occupations to remediate underlying impairments and optimize return to valued occupations. In line with one of the foundational tenets of occupational therapy practice, an emerging area of research is in the field of functional cognition. Functional cognition focuses on using routines or habits, mental techniques, and self-awareness to enhance performance in several occupational domains. Function based cognitive training is the use of "occupations as means" for cognitive skill acquisition to perform specific areas of occupations, along with compensatory strategies to improve cognitive impairments¹³. When the focus of a cognitive intervention is on returning to meaningful and valued occupations, it may help close the perceived gap often felt by patients by enhancing the generalizability, acceptability, and compliance of therapy. It is also seen that such training can be effective in engaging and handling situations that are completely new to them¹⁴.

In clinical practice, occupational therapists use multiple approaches to improve occupational performance. One such approach is the multi-context approach to cognitive rehabilitation, the Cognitive orientation to daily occupational performance (CO-OP) which focuses on the different strategies employed to facilitate the transfer of the acquired ability to several contexts and applying cognitive techniques to accomplish client-centered objectives¹⁵. It has been demonstrated that meaningful task-oriented training is advantageous for enhancing upper extremity functionality and stroke recovery¹⁶. Likewise, task-oriented methods for enhancing cognitively based instrumental daily living activities are required; training that is tailored to specific tasks to enhance cognitive abilities.

Another approach is the Neurofunctional approach which outlines learning cognitive strategies and training to facilitate cognitive skills acquisition and novel problem-solving abilities through thinking routines. This approach uses global, domain-specific and function-embedded cognitive strategies¹⁷. The goal of the approach is to develop a positive therapeutic alliance through client centered goals and direct observation of occupational performance.

Several systematic reviews have explored different types of cognitive rehabilitation techniques such as the effectiveness of attention training, memory training, executive function training and the evidence is yet to be established¹⁸⁻²⁰. A Cochrane Collaboration reviewed evidence from randomized-controlled trials and investigated the effectiveness of cognitive rehabilitation strategies in spatial neglect. It was found that neglect rehabilitation intervention strategies present with positive effects that were noticed on the standardized tests but do not significantly influence the long-term outcome as seen in functional performance such as in self-care tasks or standardized tests. It was concluded that cognitive rehabilitation strategies still need to be proven to show their effectiveness in remediating post stroke cognitive impairment (PSCI)²¹

Another systematic review revealed that cognitive strategy training has a beneficial effect on activity performance outcomes for individuals with non-progressive neurological conditions. Although a positive effect was shown, the outcome measures used were mostly focused only on basic activities of daily living and most of the included studies showed a lack of methodological rigor and a lack of focus on improvement in cognitive functions. A primary recommendation for future research included a need to consider patient experiences and acceptability of the treatment²². Another scoping review published by²³ aimed to identify literature addressing CO-OP as a primary intervention in adults with neurological conditions. This scoping review also indicated the need for a systematic review to critically appraise the included articles and comment on their effectiveness. A Cochrane review when evaluating the effectiveness of cognitive rehabilitation in occupational therapy broadly categorized the occupational therapy interventions into cognitive remediation approaches which primarily included computer-based interventions and adaptive or compensatory approaches, where only 4 studies have been included¹⁸.

Although several studies have evaluated the effectiveness of cognitive rehabilitation interventions, no comprehensive review is available on function-based training proving their effectiveness in remediating cognitive functions and occupational performance. No review has highlighted the qualitative experiences and perceptions of those delivering and patients engaging with function-based training. With emerging needs in translating innovations in stroke rehabilitation to gains in functional activities, there is a need to establish an evidence base on the effect of function-based training on cognitive functions and occupational performance²⁴. This review will focus on identifying, synthesizing, and appraising all the studies where function based cognitive interventions have been used among stroke survivors. The purpose of this review is to answer the following research question: can function-based cognitive training improve cognitive functions and occupational performance among post-stroke survivors? The review will also aim to explore the salient features of function-based cognitive training that contribute to its feasibility, acceptance, efficacy and patient perceptions.

2. Methods

The protocol is developed by following the Preferred Reporting Items for Systematic Reviews and Meta Analysis Protocols (PRISMA-P) 2015 guidelines²⁵. The systematic review protocol has been registered with the International Prospective Register of Systematic Reviews PROSPERO (CRD42024563917).

2.1. Objectives

- To assess the effectiveness of occupational therapy interventions with a focus on function-based cognitive training on cognitive functions among post stroke survivors.
- To assess the effectiveness of occupational therapy interventions with a focus on function-based cognitive training on occupational performance among post stroke survivors.
- To explore the salient features of function-based cognitive training that contribute to its feasibility, acceptance, efficacy, and patient perceptions.

2.2. Inclusion Criteria

The articles will be screened based on the inclusion criteria in Table 1.

Table 1.

<p>Design:</p> <ul style="list-style-type: none"> • All study designs focusing on the effect of function based cognitive interventions on cognitive functions among post stroke survivors • All study designs focusing on the effect of function based cognitive interventions on occupational performance among post stroke survivors
<p>Setting: Any setting practicing the intervention of interest will be included</p>
<p>Population: Post-stroke survivors.</p>
<p>Intervention: Some examples of function-based training are</p> <ul style="list-style-type: none"> • cognitive strategy training • cognitive orientation to occupational performance • the multi context approach • task specific training.
<p>Comparison: Patients receiving</p> <ul style="list-style-type: none"> • The usual standard of care • Any other cognitive rehabilitation • No other intervention
<p>Outcomes: The primary outcomes include:</p> <ul style="list-style-type: none"> • Cognitive functions such as Global mental functions (consciousness, orientation), and Specific mental functions (attention, memory and higher-level cognition). Some of the examples for cognitive skill-based assessments are Mini-Mental Status Examination (MMSE), Montreal Cognitive Assessment (MoCA), Executive Function Performance Test (EFPT), Assessment of Motor and Process Skills (AMPS), and Multiple Errands Test (MET). • Occupational performance as defined by the Occupational Therapy Practice Framework ²⁹which includes a range of occupations categorized as activities of daily living (ADL), instrumental activities of daily living (IADLs), health management, rest and sleep, education, work, play, leisure, and social participation. Some examples of tools measuring these are Canadian

Occupational Performance Measure (COPM), Occupational Performance Measure (OPM), Functional Independence Measure (FIM), Activity Card sort (ACS), Community Integration Questionnaire (CIM).

Intervention: As there are varied definitions for function-based interventions, we operationalize that any cognitive intervention within the scope of occupational therapy practice that focuses on cognition skill acquisition through performance in specific areas of occupation or client centered goals will be included in the review. Function based cognitive interventions are those that focus on use of “occupation as means” for cognitive skill acquisition in order to perform specific areas of occupations.

2.3. Search Methods

The following databases will be searched: PubMed, MEDLINE, CINAHL Complete, EMBASE, ProQuest, OT seeker. In addition to the searches made on the mentioned databases, we will also check the reference list of eligible publications and search selected journals. Prospero will also be searched to identify if any similar review has been registered. The searches will be conducted from 2014 to 2024 and only articles in English will be chosen. Conference abstracts and unpublished manuscripts will be excluded. The search terms were developed by the review authors in consultation with a librarian experienced in conducting systematic review searches. A pilot search was conducted on PubMed in order to assess if the search strategy yielded the required articles. Modifications were made accordingly, and the search strategy was finalized. Table 2 shows the search strategy developed for PubMed.

Table 2. Search strategy for PubMed: Limiters: FROM 2014-2024, ENGLISH.

#1 Function Based training
#2 function-oriented training
#3 top-down approaches
#4 performance-based training
#5 occupation-based intervention
#6 occupational therapy intervention
#7 occupational performance
#8 cognitive orientation to daily occupational performance
#9 multi context approach
#10 strategy training
#11 executive function training
#12 Function Based training OR function-oriented training OR top-down approaches OR performance-based training OR occupation-based intervention OR occupational therapy

intervention OR occupational performance OR cognitive orientation to daily occupational performance OR multi context approach OR strategy training OR executive function training
#13 Cognitive Functions
#14 cognitive skills
#15 Cognition
#16 cognitive impairment
#17 cognitive activities
#18 cognitive training
#19 cognitive remediation
#20 cognitive rehabilitation
#21 Cognitive Functions OR cognitive skills OR cognitive activities OR Cognition OR cognitive impairment OR cognitive training OR cognitive remediation OR cognitive rehabilitation
#22 post-stroke Survivors
#23 cerebrovascular accident
#24 Stroke
#25 cerebrovascular accident
#26 acquired brain injury
#27 post-stroke Survivors OR cerebrovascular accident OR Stroke OR cerebrovascular accident OR acquired brain injury
#12 AND #21 AND #27

2.4. Study Selection

Two authors will perform title and abstract screening based on the set criteria. The third author will resolve any disagreements if any confusion arise regarding the inclusion of an article in the review. Full-text screening will be performed by two researchers and will independently rate the methodological quality of included studies using an appropriate methodological quality assessment tool based on the study design. Reference management software such as Mendeley will be used to import the references to Covidence systematic review management. Covidence will be used to remove duplication, screen title, abstract, and full text and perform data extraction.

2.5. Data Extraction

Two authors will independently extract the following data: study design, study duration, study population (inclusion and exclusion criteria), intervention type, participants' demographics, outcome measures, results, and implications using Covidence systematic review management. The Cochrane data extraction templates for RCT and non-RCT will be used. For other quantitative studies, a

template was developed by following the STROBE checklist (Strengthening the reporting of observational studies in epidemiology)²⁶ as seen in Table 3. For qualitative data extraction, a template was developed by following the COREQ checklist (COnsolidated criteria for reporting qualitative research)²⁷ as seen in Table 4. The data extraction forms will also be piloted and used by the review authors to gain familiarity and make changes if needed. The extracted data will be recorded in Word and Excel sheets.

Table 3. Data extraction form for quantitative studies.

Administration Information		
Title		
Authors		
Year		
Journal		
Country of origin		
Study Information		
	Description	Summary
Objectives	Specific objectives mentioned in the study	
Study design	Present key elements of the study design.	
Setting	Setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	
Eligibility criteria	Inclusion and exclusion criteria	
	Sources and methods of selection of participants	
Variables	List all outcomes, exposures, predictors, potential confounders, and effect modifiers.	
	Definitions used	
Data sources/measurement	Tools used to measure variables of interest, their psychometric properties	
Bias	Any efforts to address potential sources of bias	

Study size	How the study size was arrived at	
Statistical methods	List all statistical methods used	
Participants	<p><i>Cohort study</i>—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up</p> <p><i>Case-control study</i>—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls</p> <p><i>Cross-sectional study</i>—Give the eligibility criteria, and the sources and methods of selection of participants</p>	
	Reasons for non-participation at each stage	
Descriptive data	Characteristics of study participants (eg demographic, clinical, social)	
	Number of participants with missing data for each variable of interest	
Outcome data	Summary of measures over time and time points	
Main results	Percentages, odds ratio, p values, other results	
Other analyses	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Summary of findings	Summarise key findings	
Funding	Give the source of funding and the role of the funders for the present study and, if	

	applicable, for the original study on which the present article is based	
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Table 4. Data extraction form for qualitative studies.

Administration Information		
Title		
Authors		
Year		
Journal		
Country of origin		
Study Information		
Personal characteristics of the researcher	Which author/s conducted the interview or focus group?	
	What were the researcher's credentials? E.g. PhD, MD	
	What was their occupation at the time of the study?	
	Was the researcher male or female?	
	What experience or training did the researcher have?	
Relationship with participants	Was a relationship established prior to study commencement?	
	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	
	What characteristics were reported about the interviewer/facilitator? e.g. Bias,	

	assumptions, reasons and interests in the research topic	
Theoretical framework	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	
Participant selection	How were participants selected? e.g. purposive, convenience, consecutive, snowball	
	How were participants approached? e.g. face-to-face, telephone, mail, email	
	How many participants were in the study?	
	How many people refused to participate or dropped out? Reasons?	
Setting	Where was the data collected? e.g. home, clinic, workplace	
	Was anyone else present besides the participants and researchers?	
	What are the important characteristics of the sample? e.g. demographic data, date	
Data collection	Were questions, prompts, guides provided by the authors? Was it pilot tested?	
	Were repeat interviews carried out? If yes, how many?	
	Did the research use audio or visual recording to collect the data?	
	Were field notes made during and/or after the interview or focus group?	

	What was the duration of the interviews or focus group?	
	Was data saturation achieved?	
	Were transcripts returned to participants for comment and/or correction?	
Data analysis	How many data coders coded the data?	
	Were themes identified in advance or derived from the data?	
	What software, if applicable, was used to manage the data?	
	Process by which themes/inferences were derived	
	Did participants provide feedback on the findings?	
Results	Central and sub-themes with brief description	
	Copy important participant quotes	
	Author's key conclusions	
	Transferability	
	Limitations	
Funding		

2.6. Data Analysis

The Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach will be used to determine the certainty in evidence. GRADE assesses the limitations in study design, indirectness, imprecision, inconsistency, and publication bias. For experimental studies, the limitations in the study design of the individual studies will be determined by checking if there is a lack of allocation concealment, lack of blinding, incomplete accounting of outcome events, selective outcome reporting, and/or other limitations. Cochrane risk of bias tool (RoB 2) for RCTs will be used, JBI Critical Appraisal Tool will be used for assessing the quality of non-randomized trials. The Mixed Methods Appraisal Tool can be used to assess quantitative and qualitative studies.

If the data extracted is homogenous, a meta-analysis will be performed. If there is statistical or clinical heterogeneity present, a narrative synthesis will be conducted. Data extracted will provide a comprehensive view into the types of function based cognitive interventions practiced, the relationship between function based cognitive interventions and remediation of cognitive

impairments post stroke. Narrative synthesis will be done, and themes will be generated from the included articles²⁸. The salient features of such interventions contributing to their efficacy, acceptability, feasibility, patient perceptions and experiences will be highlighted. Stakeholder perspectives and knowledge of the therapist and others will be explored. If data is available, subgroup analysis comparing the severity and chronicity of stroke, patient age groups and ethnic background could be performed.

3. Discussion

The purpose of this systematic review is to explore the effectiveness of function based cognitive interventions among stroke patients. Occupational therapy often uses both impairment-specific models such as bottom-up approaches and function-based models such as top-down approaches. Function based cognitive training is versatile and serves several purposes, in terms of addressing patient priorities, targeting intrinsic factors such as motivation and satisfaction, and providing tangential improvements. By functionally translating cognitive tasks, this method not only addresses cognitive deficits but also leads to improvements in practical, everyday contexts. Quantitative measures of effectiveness as well as qualitative experiences of the patient, family and key stakeholders will help shed more light into the use of function based cognitive training among stroke patients. These results may support the adoption of function-based training in stroke rehabilitation programs and highlight the importance of targeting both cognitive and functional aspects of recovery.

4. Conclusions

Function-based cognitive training demonstrates significant potential in enhancing cognitive functions and improving occupational performance among post-stroke survivors. By embedding cognitive exercises within practical, daily tasks, this approach effectively addresses cognitive impairments and translates improvements into meaningful gains in everyday functioning. The study's results will highlight the benefits of incorporating function-based training into stroke rehabilitation programs, making inferences to the improvement of a client's cognitive abilities and occupational performance. These findings support the continued exploration and integration of function-based training strategies in stroke recovery efforts. The findings of this study could further cognitive rehabilitation policy and guideline development. It could also aid in building an evidence base for occupational therapists in cognitive rehabilitation.

Author Contributions: VN conceptualized the study and was involved during methodology, investigation and in writing the original draft. VN is also the guarantor of this review. RS was involved during conceptualization, methodology, supervision and validation. VOP was involved in the preliminary writing of the original draft and in investigation. TA was involved during the methodology and in writing – review and editing.

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