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A Scoping Review of Occupational Therapy Approaches to Enable Occupations for People Living with Behavioral Disturbance as a Result of Acquired Brain Injury

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A Scoping Review of Occupational Therapy Approaches to Enable Occupations for People Living with Behavioral Disturbance as a Result of Acquired Brain Injury

Abstract

Background: Behavioral disturbance impacts almost 50% of people living with acquired brain injury (ABI) and severely impedes occupational participation. Occupational therapists are appropriately qualified and well placed to address behavioral disturbance. This scoping review analyzes the literature to ascertain approaches used by occupational therapists to treat behavioral disturbance.

Method: A literature search of three databases revealed 379 papers for consideration, five of which met inclusion criteria. The *Critical Appraisal Skills Programme* (CASP) checklists were used for the analysis. This paper employs the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) framework.

Results: Sensory modulation interventions, community-based interventions, behavior therapy, and neurofunctional activity of daily living (ADL) retraining were identified as approaches that could be used by occupational therapists to promote participation for people living with behavioral disturbance after an ABI.

Conclusion: According to current occupational therapy literature, evidenced-based behavioral interventions to enable participation for almost half of people living with an ABI are lacking. To promote the occupational therapy role in this area of rehabilitation, further empirical research is needed.

Comments

The authors declare that they have no competing financial, professional, or personal interest that might have influenced the performance or presentation of the work described in this manuscript.

Keywords

brain injury, behavior, treatment, aggression, agitation, neurological

Cover Page Footnote

The research underpinning this publication was undertaken while completing a PhD at La Trobe University, Melbourne, Victoria. I would like to acknowledge my PhD supervisors, Associate Professor Tracy Fortune and Dr. Tamara Tse from La Trobe University, Melbourne Australia, without whom this research would not have been possible.

Credentials Display

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Acquired brain injury (ABI) impacts sixty-nine million people worldwide each year, with an estimated 25% to 42% experiencing associated behavioral changes, including irritability, aggression, adynamia, and impulsivity, to name a few (Dewan et al., 2019; Elliot, 2021; Rao et al., 2009; Visscher et al., 2011). Such behaviors after brain injury can last for years, inhibiting individuals' occupational participation, and have been described as the most disabling aspects requiring attention to support optimal rehabilitation (Kelly et al., 2008; Visscher et al., 2011). Behavioral changes can lead to poor outcomes in recovery and reduced likelihood of a successful discharge back into the home environment. The behavior of some individuals has resulted in imprisonment or placement in secure accommodation post rehabilitation (Alderman et al., 2013; Charles & Butera-Prinzi, 2008; Kelly et al., 2008; Synapse, 2019). The impact of behavioral changes post ABI can be catastrophic for the family and the client, as physical and verbal aggression is often directed at loved ones (Kelly et al., 2008). Families experiencing grief as a result of behavioral changes in their loved one, combined with trauma from aggression, mood swings, and unpredictability, can also experience long-term relational trauma (Charles & Butera-Prinzi, 2008). The occupational consequences of unaddressed behavioral symptoms can include decreased participation in necessary and valued occupational roles, which modifies occupational identity and competence. This disengagement from meaningful occupations can be destructive and contribute to a negative self-narrative (Taylor & Kielhofner, 2017).

Occupational therapists are key members of the multidisciplinary team in neurological rehabilitation and play an integral role in promoting participation for individuals experiencing ABI. Occupational therapists uniquely understand that participation arises when a person's inherent performance capacity, habits, and volition are married to an appropriate environmental context; these merged conditions can either hinder or optimize participation (Taylor & Kielhofner, 2017). Despite this, occupational therapy assessment and treatment foci most commonly cited by the American Occupational Therapy Association include cognitive assessment and treatment, assessment of activities of daily living, environmental adaptations, and equipment prescription (Greenwald, 2010). It has been suggested in the literature that the behavioral sequela of ABI are stigmatized and therefore often not addressed in ABI rehabilitation, meaning that physical rehabilitation of the injury takes precedence (Butera-Prinzi et al., 2016). It is likely that both physical rehabilitation gains and broader occupational participation outcomes are compromised when habituated behavioral symptoms are unaddressed (Butera-Prinzi et al., 2016). Occupational therapists are uniquely placed as health professionals to consider the person from a holistic, biopsychosocial perspective. With this in mind, psychosocial, behavioral, and emotional factors need to be considered and addressed by occupational therapists in ABI rehabilitation (Wheeler et al., 2007).

Our research question was twofold: What approaches are occupational therapists employing to manage challenging behaviors associated with adult ABI, and what does the literature say about the effectiveness of these approaches? The search terms for this scoping review are identified in Figure 1: PICOS Table, and includes the study population, intervention, comparisons, outcomes, and study designs.

The aim of this scoping review was to explore the approaches occupational therapists use in adult ABI rehabilitation to treat and manage behavioral symptoms, and what the literature says about the effectiveness of these approaches. Current literature highlights a need for this review with statistics highlighting high prevalence of behavioral changes post ABI, an impact on function, and a gap in identified treatment methods for occupational therapists (Alderman et al., 2013; Rao et al., 2009). Dissemination of the findings of this review will increase occupational therapists' awareness of behavioral changes post ABI and outline approaches currently being used to treat them. Because

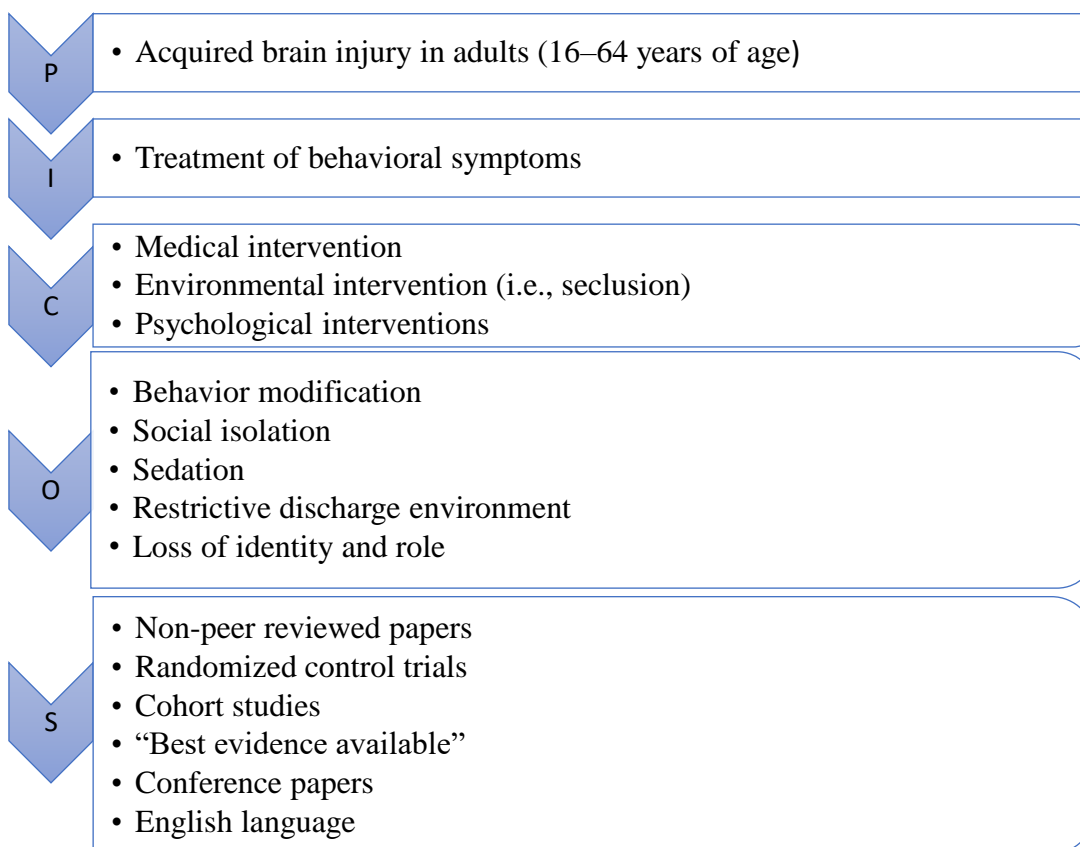
of limitations of existing reviews, a significant need exists to conduct an accurate and comprehensive review of this topic.

Method

This scoping literature review employs the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework (Moher et al., 2009).

Figure 1

PICOS Diagram



Note. PICOS = Population, Intervention, Comparison, Outcome, Study Design.

An electronic database search was conducted between June and August 2018 in MEDLINE, CINAHL, and PsychInfo databases. These databases were used as they are authoritative and concerned with life sciences, psychology, and allied health, all of which are relevant to the research question for this scoping review. This literature search was rerun in January 2020 to ensure currency of literature before publication. Inclusion criteria consisted of papers printed in English, focused on occupational therapy approaches, working with the adult (16–64 years of age) ABI population with behavioral difficulties associated with their ABI. Non-peer reviewed works were included to broaden our scope of knowledge on current approaches used by occupational therapists in this field. The Victorian State Government’s definition of ABI was used as a guide for inclusion criteria: “Acquired brain injury refers to any type of brain damage that occurs after birth. It can include damage sustained by infection, disease, lack of oxygen or a blow to the head” (Victoria State Government, 2018). Research conducted in the field of neurodegenerative conditions as well as stroke, traumatic head injury, concussion, and so forth were included. Limitations were applied to works published

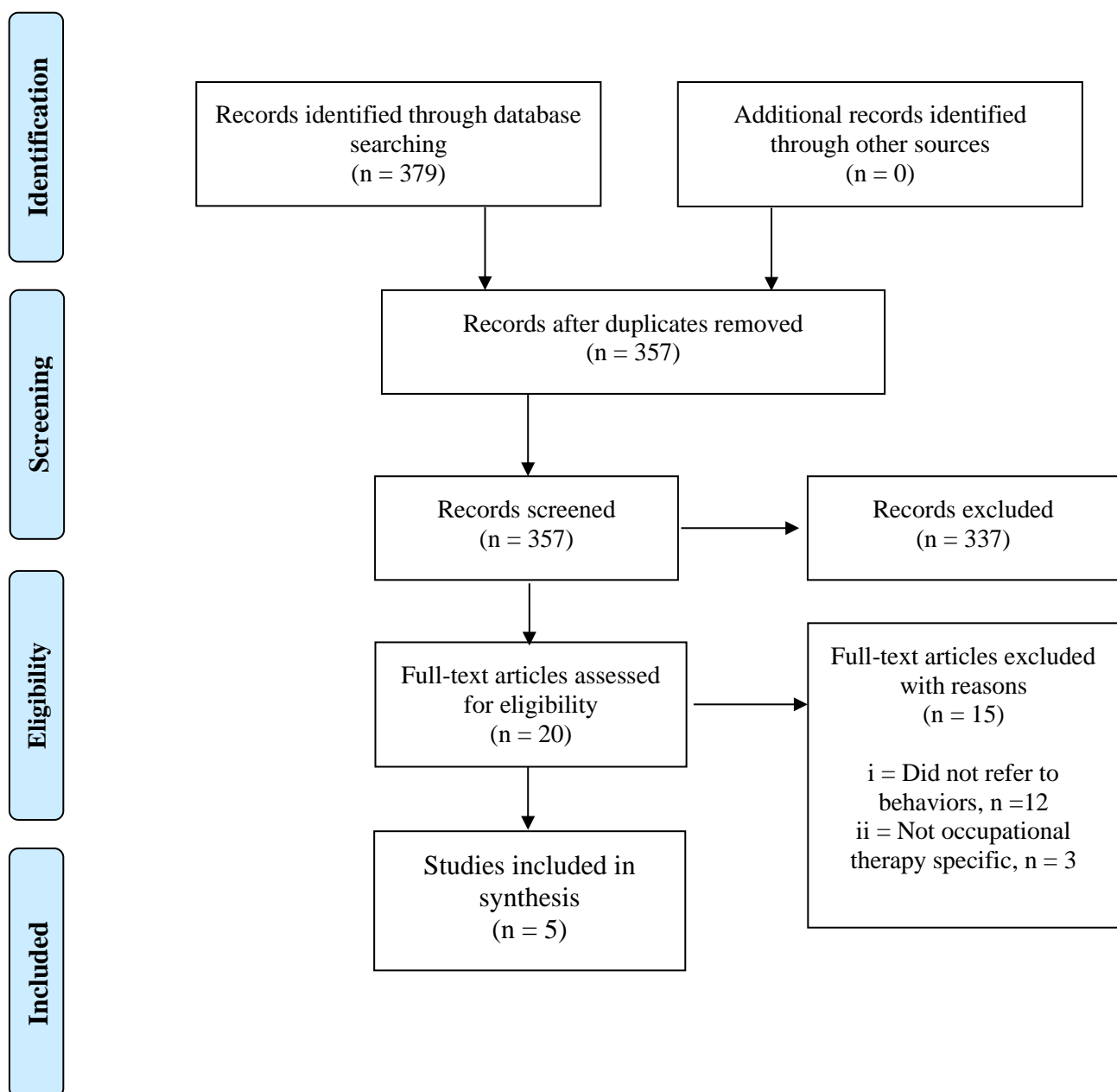
between 2008–2020. Exclusions included older persons (above 64 years of age), children (under 16 years of age), people living with an intellectual disability, upper limb research, or physical rehabilitation not centered on addressing behavioral concerns. Synonyms and Boolean operators were used to elicit optimal results.

The searches revealed 379 papers, with a final 357, once 22 duplicates were removed. These were screened by the first and fourth author using the COVIDENCE system (Veritas Health Innovation, n.d.). Titles and abstract were screened which resulted in 337 exclusions, leaving 20 papers to be reviewed in full text. Fifteen papers were excluded as they did not meet inclusion criteria, leaving five for critical appraisal. One of the five was published in 2008, and since the literature was initially screened in 2018, this paper was included.

Results

Figure 2

Literature Search Results



The *Critical Appraisal Skills Programme* (2019) checklists were used for the analysis of the five research papers. These were conducted by the first author and screened by the third and fourth authors to minimize bias.

Five papers met the inclusion criteria for this scoping review. Table 1 details the characteristics of these studies.

Table 1
Characteristics of the Included Studies for Analysis

Author	Year	Title	Study design	Participants/ number of studies analyzed	Interventions used by occupational therapists'	Outcomes according to paper author
Hildebrand, M.	2015	<i>Effectiveness of Interventions for Adults with Psychological or Emotional Impairment After Stroke: An Evidence-Based Review</i>	Evidenced based review	39 papers were included for analysis, 37 of which were classified as Level I, one at Level II and at Level III	i = Exercise or movement-based interventions ii = Behavior and stroke education iii = Behavior therapy only iiii = Stroke education only v = Care support and coordination only iv = Community based interventions	i = Insufficient evidence to support or refute exercise or movement-based interventions ii = Insufficient evidence to support or refute behavior and stroke education iii = Some support for problem-solving and motivational interviewing iiii = Evidence not sufficient v = Inconsistent evidence iv = Some support for a community, leisure activity program
Nott, M., & Chapparo, C.	2008	<i>Measuring Information Processing in a Client with Extreme Agitation Following Traumatic Brain Injury Using the Perceive, Recall, Plan and Perform System of Task Analysis</i>	Single case study of a man with first onset brain injury, displaying severe agitation, in PTA on an inpatient rehabilitation unit	One person	The Perceive, Recall, Plan and Perform (PRPP) System of Task Analysis is a two-staged, standardized criterion-based assessment. In this instance it was used to observe and assess task performance, mainly in regard to information processing in the areas of dressing, meal and drink preparation for a client with extreme agitation	The PRPP provides occupational therapists with guidance on categorizing errors in information processing in those with severe agitation post brain injury Not designed as an occupational therapy intervention
Padilla, R., & Domina, A.	2016	<i>Effectiveness of Sensory Stimulation to Improve Arousal and Alertness of People in a</i>	Systematic review	Nine studies were reviewed, three of which were classified Level I, one as Level II, four	i = Unimodal stimulation ii = Multimodal stimulation iii = Median nerve stimulation (MNS)	i = Auditory stimulation in the use of the clients' own name can elicit a response, otherwise there was insufficient evidence to support

		<i>Coma or Persistent Vegetative State After Traumatic Brain Injury: A Systematic Review</i>		as Level III and one as Level IV according to Sackett et al. (1996)'s evidence hierarchy		unimodal stimulation ii = Attention and cognition were significantly improved after 6–14 days of 7–20 min sessions, 3–5 times a day of multimodal stimulation iii = Insufficient evidence as to whether MNS significantly increases arousal
Brown, A., & Fisher, C.	2015	<i>Optimizing Occupational Performance Through Sensory Modulation Interventions: Case Reports of Two Young Adults Diagnosed with Juvenile Huntington's Disease</i>	Case report of two people with diagnosis of juvenile Huntington's Disease in an inpatient neurobehavioral unit	Two people	Individually tailored sensory modulation interventions, such as weighted blankets, massagers, flavored foods and condiments, squeeze balls, reduction in environment auditory stimulation.	Behavioral symptoms (verbal and physical aggression, impulsivity, delusions, and paranoia), lessened with sensory modulation interventions
Trevena-Peters, J., Ponsford, J., & McKay, A.	2018	<i>Agitated Behavior and Activities of Daily Living Retraining During Posttraumatic Amnesia</i>	Secondary data from a previous randomized control trial in 2017	104 adult participants diagnosed with severe TBI, in PTA, receiving inpatient rehabilitation. 55 randomized to treatment as usual (TAU) and 49 assigned to treatment	60 min of individual ADL skills retraining each weekday, in addition to TAU; in the areas of bathing, grooming, dressing, self-feeding, and light meal preparation. Errorless and procedural learning principles from Giles and Clark-Wilson's (1993) neurofunctional approach to task-specific training were used. The Agitated Behavior Scale was used to objectively assess agitation	A non-statistically significant downward trend in agitation in the treatment group Average agitation score between group difference = p. 09 Peak agitation score between group difference = p. 20 Clinically agitated days between group difference = p. 13

Figure 2 outlines the filtering of the papers and Table 1 highlights the individual characteristics and summary of data extracted from the five included papers for this scoping review. Two of the studies were conducted in America and three in Australia. The sample population includes adults diagnosed with Juvenile Huntington's Disease and Traumatic Brain Injury (TBI), including those in vegetative states and posttraumatic amnesia (PTA) and stroke. Of the five papers included in the scoping review, two were case studies based in Australian inpatient rehabilitation settings, one was secondary data obtained from an Australian randomized control trial, and the other two were conducted in America as systematic reviews. Of the three Australian studies, one was centered on the rehabilitation of two adults diagnosed with juvenile Huntington's Disease in a

neurobehavioral unit and the other two related to adults living with a TBI, in which all study participants exhibited agitation. The single case study and randomized control trial population were in a state of PTA and the clients with Huntington's Disease had been diagnosed some years prior to the study.

Across the five papers in this scoping review, occupational therapy researchers treated behavioral disturbance with four distinct approaches: sensory modulation interventions, community-based interventions, behavior therapy, and neurofunctional activity of daily living (ADL) retraining. Below is a discussion of the efficacy of each approach.

Sensory Modulation Interventions

Sensory modulation interventions as defined by Brown, Tse, and Fortune (2018) can be considered the umbrella term for multi-model stimulation, which is described in the systematic review by Padilla and Domina (2016). Six to 14 days of sensory modulation interventions may aid in treating behavioral disturbance in adults with TBI in a persistent vegetative state. Interventions included (a) bouncing on a trampoline (vestibular stimulation) while listening to music (auditory stimulation) for 7 min, three times a day (weeks not detailed); (b) a familiar person greeting the patient by name (auditory stimulation) while stroking their hands and face (tactile stimulation); and (c) stimulation of five sensory systems through twice daily sessions, five days a week for a minimum of two weeks. Effect on behavior is not directly referred to, however, an improvement in attention and cognition indicates increased arousal from a vegetative state. Confounding factors such as the natural recovery process and neuroplasticity that take place after brain injury could account for improvement in arousal and cannot be ruled out. Potential adverse effects for sensory modulation interventions are not documented.

Sensory modulation interventions such as weighted modalities, massagers, and fidget tools have also been used to increase occupational performance for two adults with diagnosed juvenile Huntington's Disease (Brown & Fisher, 2015). The setting in this instance was an Australian, secure, subacute neurobehavioral unit. Prior to admission, the clients were non-responsive to medications and other forms of behavior support in the community. Sensory modulation interventions were tailored to the client's individual sensory preferences through standardized and non-standardized assessments, and treatment plans were developed that targeted seven varying senses, sometimes one at a time, and at times, simultaneously. Subjective, observational measures described an improvement in occupational performance, including a decrease in aggression and agitation. A confounding factor that needs to be considered is that behaviors may have improved because of environmental adaptation from the community to a secure setting.

Complex environments, such as the kitchen or bathroom where there are constant changes in visual, olfactory, auditory, and tactile processing, can be overstimulating for clients after a brain injury (Nott & Chapparo, 2008). Under the sensory modulation umbrella, considerations need to be made in occupational therapy practice to account for the sensory environment when implementing rehabilitation approaches.

Community-Based Interventions

Community-based leisure approaches may be effective in preventing emotional impairment after stroke (Hildebrand, 2015). This approach may aid in emotional regulation; however, neither the details of what constitutes emotional disturbance and regulation were provided in this qualitative literature review, nor were details of the leisure program that was used in the single study to support this. Given the limited details outlined above, the overall evidence to support community-based leisure approaches for behavioral rehabilitation by occupational therapists is weak.

Behavior Therapy

Problem-solving and motivational interviewing fall under the umbrella of behavior therapy and are specified as potential approaches to treat behavioral disturbance for those living with brain injury (Hildebrand, 2015). Details of any program used by occupational therapists were not provided in the literature, and there was no clarity on behavior support being a recognized area of expertise for occupational therapists. A number of the studies analyzed in the literature review by Hildebrand (2015) were not specific to occupational therapy despite the aim of the literature review being to evaluate occupational therapy interventions. Therefore, it is not possible to discern the occupational therapy role in this context. The lack of clarity of this literature review may be indicative of the dearth of literature uncovered and the author attempting to broaden the scope of the results. This leaves the evidence for problem-solving and motivational interviewing as an occupational therapy approach for behavioral rehabilitation weak.

A Neurofunctional Approach to ADL Retraining

ADL skills retraining was another occupational therapy approach uncovered in this scoping review to help manage behavioral disturbance with people in PTA after brain injury (Trevena-Peters et al., 2018). A neurofunctional approach to task specific training embeds errorless and procedural principles, which are focused on habituating routines where mistakes are limited (Clark-Wilson et al., 2014; Giles, 1993). Sixty min of this approach to ADL retraining in the areas of dressing, grooming, bathing, self-feeding, and light meal preparation may aid in reducing agitation. Results from the Agitated Behavior Scale showed there was a trend toward lower agitation scores and fewer agitated days in the treatment group; however, the difference was not statistically significant (see Table 1). The additional 60 min of ADL retraining combined with the neurofunctional approach may have underpinned the lowered agitation, as could have the consistency and familiarity of receiving treatment from the same occupational therapist daily (Trevena-Peters et al., 2018). Although the findings were not statistically significant and cannot be considered as strong evidence in this scoping review, the paper challenges an accepted proposition that incorporating ADL retraining during PTA causes overstimulation and agitation. This is clinically important for occupational therapy practice and rehabilitation outcomes for people living with ABI.

Discussion

We set out to systematically discover what approaches occupational therapists were using with behaviorally disturbed adults living with ABI to improve occupational participation. Limited evidence exists in the literature detailing approaches to this practice, with only four treatments identified as possible approaches that could be used by occupational therapists, one being sensory modulation interventions. Our findings suggest that there is anecdotal evidence to support individualized sensory modulation treatments for behavioral rehabilitation post ABI. Such interventions are successfully used by occupational therapists working in other fields of practice, such as mental health, to improve self-regulation and occupational participation. Sensory modulation interventions have been reported as effective in regulating behaviors and have little to no adverse effects (Mullen et al., 2008). People living with ABI present similarly to those with mental illness in regard to behavioral disturbance and, therefore, this approach has potential to be transferred across settings. However, people living with ABI have added medical complexities, such as thermoregulation dysfunction, seizures, pressure areas, hypotonicity, reduced active range of motion (which may inhibit the ability for people to remove or alter sensory tools they dislike), and sometimes severe cognitive impairment, which raises concerns over consensual treatment. These

issues need to be considered in regard to risk if considering transferability of sensory modulation interventions intended for people living with mental illness to those living with ABI.

It is standard practice for occupational therapists to work with people living with ABI in the community and findings associated with this supports the continuation of community-based rehabilitation (Arblaster et al., 2017). Community-based rehabilitation poses little to no risk of adverse effects among people living with ABI (Doig et al., 2009; Wheeler et al., 2007). Therefore, Hildebrand's (2015) research on this approach is widely supported in the occupational therapy literature. However, there is a lack of clarity as to the specific leisure-based occupations used in the research, and the direct link between the approach and the person's behavioral changes is absent. As such, community-based approaches to treat behavioral disturbance for people living with ABI cannot be reliably generalized in this context currently.

Behavior therapy used as an approach by occupational therapists to treat behavioral disturbance in the ABI population should be considered with caution. Additional experience, qualifications, and training are generally needed in order for occupational therapists to safely and effectively treat people living with ABI using psychological approaches (Australian Association for Cognitive and Behaviour Therapy, 2020). Behavior therapy training undertaken as a core aspect of educational preparation by a neuropsychologist means that this professional group may be more appropriately qualified to implement such treatments with this client group (Elbaum & Benson, 2007).

A neurofunctional approach to ADL retraining has been shown to clinically assist in rehabilitation of personal care for people with brain injury and associated behavioral disturbance (Trevena-Peters et al., 2018). This approach was specifically designed for people living with brain injury to promote routines that can optimize participation in functional tasks (Clark-Wilson et al., 2014). It can be used in inpatient or community settings as it provides structure for the development and maintenance of ADL skills (Clark-Wilson et al., 2014). Errorless and procedural learning approaches embedded in this practice, juxtaposed with administration from a familiar occupational therapist, could be considered as a behavioral support approach for this complex group during PTA. However, further research is needed to support this, as currently only one paper exists to support this approach with people displaying behavioral disturbance after ABI, and the results in this context are statistically weak.

Limitations

Five papers were found in the literature that met inclusion criteria, four of which detailed anecdotal evidence to support several occupational therapy interventions. Therefore, with a small study size it is not possible to provide conclusive occupational therapy approaches for treatment of behavioral symptoms post ABI. This indicates a need for further research in this field, particularly the use of sensory modulation interventions, as a possible tool for occupational therapists to treat behavioral disturbance and improve occupational participation. It is possible also that occupational therapy behavioral outcomes are being captured in studies where addressing behavior is not the primary objective, but rather a subsequent outcome from functional interventions whereby non behavior specific frameworks and approaches are being used, such as the RCT example included in this study. Regardless of the reasoning behind the lack of evidence, the lack of evidence exists when comprehensively searching the literature using behavioral language, and therein lies the problem faced in this scoping review.

Conclusion

Our review identifies a significant gap in the literature, whereby occupational therapists do not have an identified suite of sound evidenced-based approaches to treat behavioral disturbance and promote occupational participation post ABI. According to the best available evidence in this scoping review, there is anecdotal support for occupational therapists to consider the use of sensory modulation approaches to treat behavioral disturbance in people living with ABI. These would need to be assessed and tailored to the individual and their medical issues to optimize participation and ethical practice. Mental health literature reflects that net benefits outweigh the adverse effects of sensory modulation interventions; however, further empirical research in the ABI field is needed to increase the quality of evidence. Community-based leisure approaches are considered the “bread and butter” of occupational therapy practice, yet there is insufficient evidence to support such approaches to promote occupations for people living with ABI associated behavioral disturbance. Behavior therapy would be considered in many rehabilitation settings as the neuropsychologists’ role, but this is not to suggest that occupational therapists would not play an important role in providing a form of behavior support if qualified to do so. The provision of behavior support may depend on the skill set of the individual occupational therapist. There is weak statistical evidence to support a neurofunctional approach to ADL retraining for people in PTA with behavioral disturbance, hence further research is needed.

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