Effectiveness of Occupation- and Activity-Based Interventions to Improve Everyday Activities and Social Participation for People With Traumatic Brain Injury: A Systematic Review

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This systematic review presents research on the effectiveness of occupation- and activity-based interventions to improve everyday activities and areas of occupation and social participation for people with traumatic brain injury (TBI). Nineteen studies identified through a comprehensive database search were reviewed and synthesized into five themes: (1) multidisciplinary and interdisciplinary treatment approaches, (2) community-based rehabilitation programs, (3) treatment approaches using client-centered goals and relevant contexts, (4) social skills training and peer mentoring interventions, and (5) community mobility interventions. Evidence supports the use of multidisciplinary and interdisciplinary approaches across a variety of settings, with no single treatment approach or setting clearly superior to another. The specific contributions of occupational therapy practitioners and the nature of occupational therapy interventions have not been well studied, making it difficult to determine the extent to which occupation- and activity-based interventions provided by occupational therapy practitioners improve occupational performance and social participation after TBI.


Each year, approximately 1.7 million people in the United States are diagnosed with a traumatic brain injury (TBI), and an estimated 2.5–6.3 million people currently live with a TBI-related disability (Faul & Coronado, 2015). For many people, changes in cognitive, behavioral and emotional, and physical performance adversely affect participation in everyday life.

For example, Dikmen, Machamer, Powell, and Temkin (2003) found that 35% of a consecutive series of patients with moderate to severe TBI had not returned to preinjury function in personal care at 3–5 yr postinjury, with 40% experiencing limitations in home management tasks; 50%, limitations in social integration; 40%, limitations in major activity; and 40%, limitations in leisure and recreation. In a retrospective study of outcomes up to 24 yr after moderate to severe TBI, Colantonio et al. (2004) reported that approximately 10% of the study sample needed assistance to perform basic self-care activities; 20%, assistance with meals and taking medicine; and 30%, assistance with shopping and managing money. These limitations in participation in everyday life can negatively affect a person’s life satisfaction. For example, 84% of those who had not returned to preinjury levels of participation in home management (Powell, Temkin, Machamer, & Dikmen, 2007) or leisure activities (Wise et al., 2010) by 1 yr postinjury were bothered to some degree by those changes.

Employment is also frequently affected by TBI, especially for people with more severe injuries. A recent study estimated a 60% unemployment rate at 2 yr...
post-TBI for former rehabilitation inpatients ages 16–60 compared with an average unemployment rate of 9% (Cuthbert et al., 2015). Social isolation can be another major concern, with survivors having less frequent contact with family and friends and less involvement in activities that include other people (Gordon, Cantor, Dams-O’Connor, & Tsauosides, 2015; Wise et al., 2010). In one study, one-third of those with severe TBI reported having no friends, and 10% reported complete isolation at an average of 14 yr postinjury (Hooftien, Gilboa, Vakil, & Donovick, 2001).

Occupational therapy practitioners have the potential to play a key role in reducing long-term disability from TBI by facilitating the participation of TBI survivors in everyday activities, areas of occupation, and social roles. Knowing which treatment approaches and interventions maximize occupational performance outcomes is of utmost importance to clinicians working with this complex population. In some instances, a remediation approach may be most effective. For others, a compensatory approach may be indicated, or a combination of the two approaches may be the most beneficial. To better understand how best to make these critical decisions, this systematic review addresses the question “What is the evidence for the effectiveness of occupation- and activity-based interventions to improve everyday activities and areas of occupation and social participation for people with traumatic brain injury?”

Method
This systematic review is one of six reviews of the TBI literature relevant to occupational therapy conducted under the auspices of the American Occupational Therapy Association (AOTA) Evidence-Based Practice (EBP) Project. The six review questions were based on an earlier set of reviews that covered the literature from 1986 to 2008 and were updated to reflect present clinical practice. An advisory group consisting of experts in the field and the review authors provided feedback on the development of the questions. The reviews were carried out through academic partnerships with the review team for this question, which consisted of three occupational therapy practitioners: one faculty member, one PhD student, and one clinician. The methods for the reviews were specified in advance and documented in a protocol for the authors.

Search Strategy
The inclusion criteria for all of the reviews were as follows: Studies were published in peer-reviewed scientific literature between 2008 and 2013, 50% of participants in the study sample were adults with TBI, articles were written in English, and interventions were within the scope of practice of occupational therapy. For the purpose of this review, it was not required that the study intervention be delivered by an occupational therapy practitioner. The occupational therapy intervention types were operationally defined using the second edition of the Occupational Therapy Practice Framework: Domain and Process (AOTA, 2008), the edition in place when the data abstraction was conducted. Occupation-based interventions were defined as client-centered interventions “in which the occupational therapy practitioner and client collaboratively select and design activities that have specific relevance or meaning to the client and support the client’s interests, need, health, and participation in daily life” (AOTA, 2008, p. 672), whereas activity-based interventions (i.e., purposeful activity) were defined as “goal-directed behavior or activity within a therapeutically designed context that leads to an occupation or occupations” (p. 674). Decisions as to whether a study intervention incorporated occupations or activities were based on the available intervention description, the literature describing typical clinical practice, and the review team’s experience in multiple practice settings.

Using the evidence hierarchy described by Sackett, Rosenberg, Muir Gray, Haynes, and Richardson (1996), descriptive outcome studies such as single-subject and case series designs (Level IV evidence) and case reports, narrative literature reviews, and consensus statements (Level V evidence) were included only when Level I (systematic reviews, meta-analyses, randomized controlled trials [RCTs]), Level II (two-group nonrandomized studies), and Level III (one-group nonrandomized studies) evidence was not found. The reviews excluded qualitative studies and reports from presentations, conference proceedings, non–peer-reviewed research literature, dissertations, and theses.

The methodology consultant to the AOTA EBP Project and AOTA staff identified the search terms in consultation with the review authors and the advisory group, with the terms selected in keeping with the specific thesaurus of each database included in the search. A medical research librarian with experience in completing systematic review searches further refined the search strategies and conducted all searches. The databases and sites searched included Medline, PsycINFO, CINAHL, OTseeker, and the Cochrane Database of Systematic Reviews. The review teams examined reference lists from articles that were identified for inclusion for additional potential articles, and selected journals were hand searched to ensure that all appropriate articles were included. See Supplemental Appendix 1 (available online at http://otjournal.net; navigate to this
article, and click on “Supplemental”) for one of the electronic search strategies for this question.

**Study Selection, Data Extraction, and Risk of Bias Assessment**

The EBP Project methodology consultant first eliminated references for each question on the basis of citations and abstracts. The review team (the authors) then eliminated additional references on the basis of citations and review of the abstracts. We retrieved the full-text versions of the articles for the remaining references and reviewed them for relevance to the question, study quality, and levels of evidence. Each included article was abstracted using an evidence table that included the level of evidence, a summary of the study methods, and findings relevant to the review question. AOTA staff and the consultant reviewed the evidence tables to ensure quality control before we undertook a more in-depth review and summarization.

We assessed the risk of bias of individual studies using the methods described by Higgins, Altman, and Sterne (2011). The method for assessing the risk of bias of systematic reviews was based on the measurement tool developed by Shea et al. (2007). Each study was reviewed for bias risk independently by two of the authors, with discussion and resolution of discrepancies with input from the third author as needed. All studies were included in the data synthesis regardless of the degree of bias risk; bias risk was taken into consideration in evaluating the strength of the evidence.

**Data Synthesis Methods**

Given the heterogeneity of the included studies, which precluded use of a quantitative data synthesis approach such as meta-analysis, we used a narrative or qualitative synthesis approach (Liberati et al., 2009). As is typical with a qualitative approach for systematic reviews, we examined the studies selected for review for similarities across participants, settings, interventions, and outcomes and grouped related studies into themes.

Designations of the strength of the evidence for each theme were adapted from the system proposed by the Agency for Healthcare Research and Quality, U.S. Preventive Task Force (2012). The designation of strong evidence indicates consistent results from well-conducted studies, usually at least two RCTs. A designation of moderate evidence was made on the basis of one RCT or two or more studies with lower levels of evidence. In addition, some inconsistency of findings across individual studies precluded a classification of strong or moderate evidence. The designation of limited evidence was made based on few studies, flaws in the available studies, or some inconsistency in the findings across individual studies. A designation of mixed evidence indicates that the findings were inconsistent across studies in a given category. Finally, a designation of insufficient evidence was used when the number and quality of studies were too limited to make any clear classification.

**Results**

As can be seen in Figure 1, of the 1,044 references that were screened, 19 were included in the final data synthesis. The final studies included 3 articles relevant to the review question that were published before 2008 and had not been included in a previously published AOTA EBP review. Of the 15 individual studies (i.e., non–systematic reviews), 6 were from Australia, 4 from the United States, 2 from the Netherlands, and 1 each from Canada, Denmark, and the United Kingdom. Relevant study details can be seen in Supplemental Table 1 (available online at http://otjournal.net; navigate to this article, and click on “Supplemental”). Results of the risk of bias assessments can be seen in Supplemental Tables 2 and 3 (also available online).

The qualitative synthesis resulted in five categories or themes describing types of approaches or interventions that aim to improve everyday activities and areas of occupation and social participation after TBI: (1) multidisciplinary and interdisciplinary treatment approaches, (2) community-based rehabilitation programs, (3) treatment approaches using client-centered goals and relevant contexts, (4) social skills training and peer mentoring interventions, and (5) community mobility interventions.

**Multidisciplinary and Interdisciplinary Treatment Approaches**

Early rehabilitation services after TBI are often provided on an inpatient basis in a rehabilitation hospital, a rehabilitation unit within an acute care hospital, or a skilled nursing facility. In the period soon after discharge to the community, outpatient or home-based rehabilitation services are typical. People with continued difficulties may obtain community-based day treatment through comprehensive holistic programs that focus on peer feedback to increase a person’s awareness of his or her deficits in a group approach. Residential programs (e.g., neurobehavioral programs that provide intensive behavioral management) may also be available. In many programs across the spectrum of care, services are often provided by multiple disciplines working in teams.

This review found moderate evidence that a variety of multidisciplinary and interdisciplinary rehabilitation
approaches and programs are effective in improving occupational performance and participation outcomes after moderate to severe TBI, with strong evidence that no single approach or setting is clearly more effective than another. A Level I systematic review by Kim and Colantonio (2010) included 10 studies, with a range of designs and participant injury severity, of community-based rehabilitation programs that either specifically involved occupational therapy (5 studies) or included interventions that, in the authors’ opinion, occupational therapists could do (5 studies). The authors concluded that postacute rehabilitation programs enhance community integration, especially for people with moderate to severe injuries. They noted that clients in more intensive programs appeared to have better results than those in less structured, less intensive programs, which did not appear to be effective for those with mild TBI.

A rigorous Level I systematic review of comparative effectiveness studies of multidisciplinary rehabilitation by Brasure et al. (2013) included 4 studies with a lower bias risk. Comparisons included inpatient rehabilitation cognitive–didactic versus functional–experiential approaches, inpatient hospital rehabilitation versus limited home-based treatment with a focus on mental and physical exercise, and intensive community-based cognitive rehabilitation versus standard neurorehabilitation. All of these approaches included occupational therapy as part of the treatment team with the exception of the limited home treatment program, which was supervised by a psychiatric nurse, and the intensive community-based cognitive rehabilitation program, for which composition of the treatment team was not specified. The degree to which the interventions in these studies might be considered occupation or activity based rather than preparatory methods (AOTA, 2008) or tasks (AOTA, 2014) varied by approach. Brasure and colleagues found no differences in the effectiveness of the various multidisciplinary treatment approaches in promoting participation outcomes for adults with moderate to severe TBI and concluded that no treatment was clearly superior to another.

A Level II study by Ponsford, Harrington, Olver, and Roper (2006) compared traditional outpatient therapy with a multidisciplinary community-based rehabilitation

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram of published literature search.
Figure format adapted from “Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement,” by D. Moher, A. Liberati, J. Tetzlaff, & D. G. Altman; PRISMA Group, 2009, British Medical Journal, 339, b2535. Used under the terms of the Creative Commons Attribution License.
program for people with moderate to severe TBI. All patients in the traditional program received occupational therapy along with physical and speech therapy, whereas interventions for the clients in the community-based program were provided by the most relevant team members. The authors found that both programs resulted in improved performance in personal and light domestic activities of daily living (ADLs) and leisure at 2 yr postinjury. Another Level III study with a 3-yr follow-up examined outcomes from an interdisciplinary residential community reintegration program for people with chronic injury that included three modules (i.e., independent living, work and leisure, and social–emotional; Geurtsen et al., 2011, 2012). The treatment team for all modules included occupational therapy practitioners. The authors found that this program resulted in more people living independently and working. A Level III study by Wæhrens and Fisher (2007) found that an interdisciplinary inpatient rehabilitation program provided by occupational, physical, and speech therapists within functional contexts using the Affolter, Bobath, and Combes therapy approaches, respectively, decreased the effort and increased the efficiency of ADL performance in people with chronic acquired brain injury (ABI) as measured by the Assessment of Motor and Process Skills.

Community-Based Rehabilitation Programs

Five studies provided moderate evidence for the effectiveness of community-based rehabilitation programs of various types. As described above, Kim and Colantonio (2010) concluded from a Level I systematic review that postacute community-based rehabilitation programs in which interventions either were provided or could be provided by occupational therapy practitioners enhanced community integration. It appeared that more intensive programs yielded better results, especially for people with moderate to severe injuries.

Another Level I systematic review of community-based rehabilitation programs focusing on people with severe ABI included 13 studies with a range of study designs (Geurtsen, van Heugten, Martina, & Geurts, 2010). The programs included holistic day treatment with intensive cognitive rehabilitation (9 studies: 5 including occupational therapy on the treatment team, 2 without occupational therapy, and 2 in which the treatment team was not specified), residential community reintegration programs (3 studies, all of which included occupational therapy), and a residential neurobehavioral program (1 study with the treatment team unspecified). The authors concluded that comprehensive community-based rehabilitation programs appear to enhance daily life functioning and community integration, with the greatest support for holistic day treatment programs.

A third Level I systematic review by Evans and Brewis (2008) included a range of study designs, with 4 studies of interdisciplinary rehabilitation (including the study by Ponsford and colleagues, 2006), 2 studies of home-based behavioral management, 2 studies of outdoor experiential education, and 1 study each of phone counseling, educational training, and peer support interventions. Three studies, 2 of which included occupational therapy, found improvement in functional status, 1 found improvement in social and leisure participation, and 1 found improvement in employment status; the latter 2 studies did not include occupational therapy on the treatment team. The review authors noted that the interventions involving group work appeared to demonstrate greater effects than the studies focused on individual therapy.

Hopman, Tate, and McCluskey (2012) compared outcomes for participants in residential transitional living units and community-based rehabilitation programs. All programs included individual and group therapy, with therapy groups focusing on shopping, meal planning, woodwork- ing, work, and leisure depending on the program. The treatment team was not specified. This Level II study found that participants in both types of programs made significant improvements in instrumental activities of daily living skills, support needs, productivity, community participation, and social integration at 6-mo follow-up.

Client-Centered Goals and Relevant Contexts

The studies focused on client-centered goals and relevant contexts provided moderate evidence that occupation- or activity-based interventions focused on client-centered goals and delivered in a client-relevant environmental context by an occupational therapist can improve occupational performance after TBI. No clear differences were found between group and individual interventions and services provided in outpatient hospital, day hospital, and home- or community-based settings.

Client-Centered Approaches in Conjunction With Relevant Contexts. In a Level I RCT, Doig, Fleming, Kuipers, Cornwell, and Khan (2011) found that participants in an occupational therapy program focused on client-centered
goal setting and intervention, structured intervention delivery, and inclusion of realistic environmental context or features made similar gains in goal attainment and occupational performance when services were delivered in an outpatient day hospital or a home- or community-based setting. Another Level I RCT conducted by Ownsworth, Fleming, Shum, Kuipers, and Strong (2008) compared an individual intervention focused on client-centered goals delivered in relevant contexts provided by an occupational therapist, a group-based intervention approach focused on metacognitive skills provided by a psychologist, and an intervention that combined the two approaches. The findings were generally inconsistent across the postintervention and follow-up times; however, the combined intervention resulted in the greatest improvement in goal performance and satisfaction.

Kendrick, Silverberg, Barlow, Miller, and Moffat (2012) reported that a Level III study of a self-management program provided by occupational therapists aimed at addressing functional limitations in relevant personal contexts (i.e., home or community) for people with chronic mild TBI resulted in improved participant performance and satisfaction with self-identified important areas of occupations. Program interventions included symptom education, adaptive compensatory strategy training, cognitive reframing, problem solving, and goal setting.

**Therapy Provision in Relevant Personal Contexts.** A Level II study found that a group intervention focused on participants working more effectively within current environments and on maximizing environmental supports in a day hospital rehabilitation setting was more effective than standard outpatient services in improving occupational activities and independent living (Fleming, Kuipers, Foster, Smith, & Doig, 2009). The disciplines of the group intervention facilitators were not reported.

**Social Skills Training and Peer Mentoring Interventions**

Several studies reported on social participation interventions post-TBI, providing limited evidence in support of social skills training programs and peer mentoring interventions to improve some aspects of social skill functions. A Level I RCT by McDonald et al. (2008) found that a program provided by speech–language pathologists and psychologists focused on training in social behaviors and emotion decoding improved partner-directed behaviors such as reciprocal conversational skills but did not improve general social participation. Hanks, Rapport, Wertheimer, and Koviak (2012) conducted a Level I RCT of a peer mentoring program for people with moderate TBI and their significant others and found that the intervention resulted in improved coping, less chaos in the home, fewer somatic symptoms, and less alcohol abuse but did not result in significant improvement in subjective community integration.

A Level I RCT by Struchen and colleagues (2011) found that a social peer mentoring program focused on accessing the community and increasing social contact improved perceived social support but did not increase social activity level and social network size. Occupational therapy practitioners, along with other typical members of the rehabilitation team, were involved in this program as consultants to the researchers.

**Community Mobility Interventions**

The ability to get around the community safely and efficiently is critical to a person’s ability to participate in everyday life outside the home environment. The studies in this review provided limited evidence as to which treatment approaches should be used to improve community mobility for people with TBI.

A Level I RCT feasibility study by Cox et al. (2010) found that a virtual reality driving rehabilitation program delivered by a member of the research team without formal rehabilitation training improved simulated driving performance. However, the study did not include an assessment of on-the-road performance, thus limiting the generalizability of the findings. A Level II study by Lemoncello, Sohberg, and Fickas (2010) found that landmark-based directions maximized performance of people with TBI in following a walking route in the community and were preferred over cardinal and right–left directions.

**Discussion**

This review found moderate evidence that a variety of multidisciplinary and interdisciplinary rehabilitation approaches and community-based rehabilitation programs could be effective in improving occupational performance and participation outcomes after moderate to severe TBI, with strong evidence that no one approach or setting is clearly more effective than another. Moderate evidence indicates that activity-based interventions focused on client-centered goals and delivered in a relevant environmental context by an occupational therapist could improve occupational performance after TBI, and limited evidence was found as to which treatment approaches might be useful in improving social skills and community mobility. However, for many of these approaches and programs, the specific contribution of occupational therapy and the specific nature of the occupational therapy interventions are not known.
Implications for Occupational Therapy Practice

The current research evidence supports the continued participation of occupational therapists in multidisciplinary and interdisciplinary team-based programs. However, the evidence is not sufficient to determine which specific intervention approach (including activity- or occupation-based interventions) or setting would likely be most beneficial for a particular client in improving occupational performance and social participation. Clinicians need to rely on their clinical reasoning and expertise to make decisions regarding the best treatment of an individual client as part of a three-pronged evidence-based approach that also takes into consideration client preferences (Sackett et al., 1996), along with factors such as program availability and resource utilization.

Implications for Occupational Therapy Research

Additional research is needed to know how best to achieve maximal occupational performance outcomes for people with TBI and to support advocacy for access to occupational therapy and other services. Research is needed to examine the specific effects of different occupational therapy approaches and interventions across all domains of everyday activities and to determine optimal timing, frequency, and duration of services. A greater level of detail regarding the nature and extent of interventions in studies of various approaches would facilitate better understanding of the contribution of each discipline. The differential effects of client and injury characteristics on responsiveness to treatment should be examined, as should the impact of changing service delivery models. With the ethical and logistical challenges inherent in conducting RCTs, other study designs should be considered.

Implications for Occupational Therapy Education

Educators should cover multiple approaches to improving participation outcomes for people with TBI to support clinicians in effectively delivering a wide spectrum of interventions in a range of practice settings. Clinical reasoning skills should be well developed to prepare clinicians to individualize treatment to each person. Communication and other skills needed to practice effectively in interdisciplinary and multidisciplinary teams should be taught in an explicit fashion.

Limitations

This review is limited by the small number of studies overall, the relatively high bias risk and low-quality designs in many studies, and incomplete reporting of intervention details. As such, the conclusions are subject to bias and should be interpreted with caution.

Conclusion

Current research provides evidence for the use of various intervention approaches across a range of settings to improve occupational and social participation outcomes for people who have sustained a TBI. Additional research is needed to determine the nature and extent of the contribution of occupational therapy within those treatment approaches and the specific occupational intervention approaches most likely to be effective for each individual client.

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References


*Indicates studies included in this review.


