Addressing Participation in Adults With Postconcussive Symptoms Using Cognitive Strategy Training: A Feasibility Trial

Anna E. Boone, Casey Perry, Whitney L. Henderson

Importance: Some people experience persistent symptoms after a concussion that greatly affect occupational performance.

Objective: To evaluate the feasibility and preliminary effect of metacognitive strategy training in a sample of adults with postconcussive symptoms.

Design: Single-group, prospective design.

Setting: University research laboratory.

Participants: Adults with persistent concussive symptoms affecting function (N = 14).

Intervention: Ten 45-min sessions of a metacognitive strategy training intervention, Cognitive Orientation to daily Occupational Performance (CO-OP).

Outcomes and Measures: Assessed feasibility outcomes included recruitment, retention, and adherence rates, and intervention acceptability was evaluated with the Client Satisfaction Questionnaire–8. The preliminary effect was measured on occupational performance (Canadian Occupational Performance Measure), concussive symptoms (Neurobehavioral Symptom Inventory), sleep (Pittsburgh Sleep Quality Inventory), vision (College of Optometrists in Vision Development–Quality of Life Outcomes Assessment), and cognition outcomes (Dysexecutive Questionnaire, Weekly Calendar Planning Activity, and National Institutes of Health Toolbox Cognition Battery).

Results: Acceptable recruitment (32%), retention (93%), and adherence rates (100%) were observed, along with a high level of acceptability to participants. Large intervention effects were present for occupational performance, general concussive symptoms, and cognitive functioning.

Conclusions and Relevance: Findings suggest that the CO-OP is feasible to administer for adults with postconcussive symptoms and perceived as suitable for the needs of this population. Feasibility findings, coupled with improvements in occupational performance outcomes, provide the foundation for a future larger scale trial.

Plain-Language Summary: The Cognitive Orientation to daily Occupational Performance intervention is practical to use to address the functional impact of persistent concussive symptoms in adults. Further research is needed to evaluate the efficacy of the CO-OP intervention with this population.

Boone, A. E., Perry, C., & Henderson, W. L. (2024). Addressing participation in adults with postconcussive symptoms using cognitive strategy training: A feasibility trial. *American Journal of Occupational Therapy, 78,* 7802180080. https://doi.org/10.5014/ajot.2024.050396

An estimated 2.5 million traumatic brain injuries (TBIs) are evaluated each year in the emergency department; roughly 75% to 90% are classified as mild TBIs (mTBIs; Taylor et al., 2017). Despite an increased awareness of mTBIs (i.e., concussions), this number likely remains an underrepresentation of the actual number of mTBIs because of a lack of appropriate evaluation and follow-up with health care professionals (Prince & Bruhns, 2017). As awareness and identification of mTBI grows, the number of people requiring rehabilitation intervention will rise (Choe & Giza, 2015).

People with mTBI may acutely experience—separately or in any combination—somatic (e.g., dizziness), cognitive (e.g., decreased attention), and affective symptoms (e.g., irritability; Bergersen et al., 2017). Notably, the interactive effects of multiple symptoms can amplify the total impact on everyday life (e.g., lack of sleep may lead to reduced attention; Prince & Bruhns, 2017). These symptoms lead to decreased academic performance, difficulty returning to work, and an overall struggle in life participation (Chu et al., 2017; Cooksley et al., 2018). These limitations are of relatively minor consequence to the majority of people with mTBI, whose symptoms resolve within 10 days postinjury (McCrory et al., 2013). However, approximately 10% to 15% of people with mTBI have persisting symptoms and associated functional decrements for many months or years; in other words, persistent concussive symptoms (PCSs; Zemek et al., 2016).

Of the limited existing literature on PCS treatment, the majority of interventions have a primary goal of improving specific impairments. However, a focus on impairment remediation may be short-sighted, because improvements in impairments often are not sustained and largely do not translate to improvements in daily life functioning (Cicerone et al., 2011; Poppelreuter et al., 2009). A 2019 review of PCS clinical trials identified a small amount of studies that used cognitive–behavioral therapy to improve symptom and psychological outcomes, with positive results (Jaber et al., 2019; Kjeldgaard et al., 2014). The review found that interventions with the goal of improving symptoms or psychological outcomes (i.e., bottom-up interventions) did not explicitly target occupational performance outcomes.

In contrast, top-down interventions are used in an attempt to improve performance at the level of everyday activity. For example, metacognitive strategy training (MCST) interventions help clients enhance control over higher level cognitive functions (i.e., executive function) to overcome cognitive, emotional, and behavioral obstacles for improvement in occupational performance. The Cognitive Orientation to daily Occupational Performance (CO-OP) intervention, a type of MCST, is an evidence-based intervention for improving occupational performance poststroke. CO-OP uses a global problem-solving strategy: Goal–Plan–Do–Check. Use of a broadly applicable strategy in the context of meaningful occupations ensures that the intervention is salient to the client and increases the likelihood of skill transfer (Dawson et al., 2017). *Skill transfer* reflects optimal learning and refers to the ability to use a previously learned skill within a new context or task (Geusgens et al., 2007). CO-OP therapists use guided discovery methods, such as asking a series of probing questions, to support participants in analyzing their own task performance and generating potential solutions for improving performance. Strategy training interventions, such as CO-OP, use metacognition and executive functioning to teach clients how to approach everyday life difficulties, recognize performance barriers, and generate potential solutions.

Current evidence supports the use of CO-OP for addressing occupational performance in acquired brain injury populations (Dawson et al., 2009, 2013; McEwen et al., 2015; Polatajko et al., 2012). Previous literature has demonstrated skill transfer with improvement in activities that were and were not addressed in intervention (Dawson et al., 2009, 2013; McEwen et al., 2015). CO-OP has also been applied, to a limited extent, to people with PCS in two prior studies. Hunt and colleagues (2019) found CO-OP to be feasible for use in adolescents with PCS. An additional study with a single-case design ($n = 3$) piloted CO-OP with participants with TBI; one of the participants presented with PCS and demonstrated occupational performance improvements (Dawson et al., 2009). Evaluation of the feasibility of CO-OP in adults is warranted because of the differing occupations of adulthood (Wrzus et al., 2013) and the likely differential impact of PCS symptoms on occupational performance in adults as compared with that in adolescents. Literature is lacking on how best to enable return to participation in adults with PCS; however, existing literature suggests that MCST may be a viable option. In the present study, we sought to evaluate the feasibility of CO-OP in a sample of adults with PCS and to evaluate the preliminary effect on outcomes of occupational performance, cognition, and PCS symptoms.

Method

Design

A single-group, prospective design was used, with outcomes gathered pre- and postintervention. A small-scale design for feasibility evaluation is recommended early in intervention evaluation to be fiscally conservative and to inform intervention refinement should a large-scale study be warranted (Bowen et al., 2009). All study procedures were approved by the University of Missouri Institutional Review Board. All participants provided written informed consent.

Participants

Participants ($n = 15$) were recruited through colleague referral and through a university-based e-mail communication that reaches the campus and members of the community. Interested people contacted researchers by phone or e-mail and were asked to complete a prescreening survey. Those who met the initial eligibility criteria completed screening procedures (i.e., Patient Health Questionnaire–9; PHQ–9) and baseline testing in a university research laboratory. Participants were included if they had

- a concussion diagnosis,
- one or more postconcussive symptoms for 4 wk or more that inhibit performance of daily activities per self-report, and
- ages 18 to 60 yr.

Participants were excluded if they had

- severe neurological or psychiatric conditions;
- severe depressive symptoms (a score over 21 on the PHQ–9; Kroenke et al., 2001);
- an inability to read, write, or speak English fluently; or
- a lack of transportation.

Data Collection

Feasibility Outcomes

We evaluated intervention acceptability through administration of the Client Satisfaction Questionnaire–8 after intervention completion (Table 1). Feasibility outcomes also included recruitment, retention, and intervention adherence rates. Each feasibility outcome was chosen on the basis of recommendations of Bowen et al. (2009) and Tickle-Degnen (2013). Acceptability feasibility ensures that a proposed intervention is perceived as satisfactory by the intended population before large-scale employment (Bowen et al., 2009).

Preliminary Effect Outcomes

Assessment data were gathered by a trained rater who was blind to the study purpose. We evaluated occupational performance using the Canadian Occupational Performance Measure (COPM; Law et al., 2014). We evaluated the functional impact of PCS symptoms by using the Neurobehavioral Symptom Inventory (NSI; King et al., 2012). The impact of sleep and visual symptoms was evaluated further with the Pittsburgh Sleep Quality Index (PSQI; Carpenter & Andrykowski, 1998) and the College of Optometrists in Vision Development–Quality of Life Outcomes Assessment (COVD–QoL; Mozlin, 1995). Finally, we assessed cognition using the National Institutes of Health (NIH) Toolbox Cognition Battery (Carlozzi et al., 2017; Weintraub et al., 2013), the Weekly Calendar Planning Assessment (WCPA; Weiner et al., 2012), and the Dysexecutive Questionnaire (DEX; Burgess et al., 1998; Wilson et al., 1996). Each of these measures has demonstrated adequate reliability and validity; supporting citations are provided in the following text.

Canadian Occupational Performance Measure. The COPM is a semistructured interview guide for evaluating occupational performance within self-care, leisure, and productivity domains (Law et al., 2014). COPM results may be used to set goals and measure change over time. Within this study, the COPM was used to identify a minimum of five occupational performance goals. For each goal, perceived performance and satisfaction levels are separately rated on a scale of 1 to 10, with higher scores indicating greater levels of performance and satisfaction.

Neurobehavioral Symptom Inventory. The NSI is a 22-item self-report measure of neurobehavioral symptoms intended to track symptoms over time in the TBI population (Cicerone & Kalmar, 1995). The degree to which each symptom disturbs functioning over the prior 2 weeks is rated using a 5-point Likert scale ranging from 0 (*none*) to 4 (*very severe*). Meterko et al. (2012) identified a four-factor model with the following domains: affective, somatosensory, cognitive, and vestibular.

Pittsburgh Sleep Quality Index. The PSQI is a 24-item self-report measure of sleep dimensions, including quality, latency, duration, efficiency, medication use, and daytime dysfunction (Buysse et al., 1989; Carpenter & Andrykowski, 1998). A global score is derived from summing each of the sleep dimension scores, with higher scores indicating worse sleep and a score of more than 5 representing poor sleep quality.

College of Optometrists in Vision Development–Quality of Life Outcomes Assessment. The COVD–QoL is a 30-item self-report measure of the impact of visual symptoms on quality of life (Maples, 2000; Mozlin, 1995). Each item is rated according to symptom frequency with a 5-point Likert scale ranging from 0 (*never*) to 4 (*always*). There are five subscales, including accommodation, binocularity, orientation, oculomotor, and perception, with total scores ranging from 0 to 120.

Dysexecutive Questionnaire. The DEX is a 20-item self-report measure of executive function in daily life (Burgess et al., 1998; Wilson et al., 1996). Items cover four domains: emotional, motivational, behavioral, and cognitive. Each item is rated for frequency using a 5-point Likert scale ranging from 0 (*never*) to 4 (*very often*), with total scores ranging from 0 to 80.

Table 1. Feasibility Outcomes

Outcome Area	Measurement	Benchmark Criterion
Acceptability	Client Satisfaction Questionnaire–8 (Attkisson & Zwick, 1982)	Average score ≥3
Recruitment	No. enrolled/no. screened	50%
Retention	No. who completed study procedures/no. enrolled	>80%
Adherence	No. of sessions attended/total no. of sessions	>85%

NIH Toolbox Cognition Battery. The NIH Toolbox Cognition Battery is a series of cognitive tests that evaluates language, episodic memory, executive function, working memory, and processing speed (Weintraub et al., 2013). In this study, we used the iPad application for administration. We report the fully corrected T-score values with a normative mean of 50 (SD = 10). Specifically, we report the fluid cognition composite score, which reflects abilities related to problem-solving, abstraction, and adaptation to novel situations (Horn & Cattell, 1966).

Weekly Calendar Planning Activity. The WCPA is a performance-based test of executive function in which a series of appointments are sorted into a blank weekly calendar (Toglia, 2015; Toglia et al., 2017; Weiner et al., 2012). Some appointments are required to be entered into fixed times, and others are not. During the assessment, five rules must be followed (e.g., do not answer questions from the examiner). This study used the Level 3 version for adults and for older adults in which the appointments and errands to be entered are provided in paragraph form. Performance on the WCPA can be evaluated using appointment accuracy, efficiency, planning time, total time, number of rules followed, and number and types of strategies used.

Intervention

Participants engaged in 10 weekly, 45-min CO-OP sessions with a trained interventionist. Five goals were identified using the COPM. One goal was not discussed within the intervention (i.e., the untrained goal), to serve as a measure of skill transfer. CO-OP is a metacognitive strategy training intervention with a primary purpose of improving occupational performance (Dawson et al., 2017). The client and therapist collaborate to identify areas of performance breakdown within client-chosen goals. The foundation of the CO-OP process is the learning of the Goal–Plan–Do–Check metacognitive strategy. Client use of this broad strategy can increase the likelihood of skill transfer, because it can be applied in a range of occupations and environments. Clients identify a specific *goal* to address and then develop a *plan* to address areas of performance breakdown. The plan is then trialed in the *do* phase within the intervention session as appropriate and in everyday life. Finally, the client *checks* whether the plan was successful or whether modifications are needed for improved performance (Figure 1). The Goal–Plan–Do–Check global strategy is used to develop more tailored, domain-specific strategies that are used within the Plan. During this process, the therapist facilitates gradual client independence in application of the Goal–Plan–Do–Check strategy, including opportunities for generalization of learned cognitive strategies through a process called *guided discovery*. Guided discovery takes the form of methods such as asking a series of probing questions or modeling for the client. For a more thorough description of the CO-OP Approach™, please see prior CO-OP literature (Dawson et al., 2017; Polatajko et al., 2001).

Figure 1. CO-OP process example.

Data Analysis

We calculated descriptive statistics for sample demographics, intervention acceptability, and performance at pre- and postintervention for each preliminary effect outcome measure. Additionally, recruitment rate, retention rate, and adherence rate were calculated as outlined in Table 1. To determine change from pre- to postintervention, we calculated effect sizes (Hedge's g) with associated 95% confidence intervals. Hedge's g was calculated on the basis of a paired sample calculation in which the mean change from pre- to postintervention is divided by the standard deviation of the difference. Hedge's g is a more conservative estimate of effect for small sample sizes (Borenstein et al., 2021). Effect sizes were interpreted as 0.2 indicating small; 0.5, medium; and 0.8, large (Cohen, 1988). Null hypothesis significance testing was not conducted, because it is not recommended for feasibility designs (Bowen et al., 2009; Lancaster et al., 2004).

Results

A total of 14 participants with PCS completed the study (Table 2). The sample was predominately female (64.28%) and White (71.42%). The majority of the sample had experienced multiple concussions (M = 3.0, SD=1.66), and reported mild depressive symptoms.

Feasibility

There was a recruitment rate of 32% and a retention rate of 93% (Figure 2). There was a 100% adherence rate to intervention sessions. Finally, CO-OP was seen as highly acceptable as indicated by an average score

Table 2. Sample Demographics (*N* = 14)

Variable	*M* (*SD*)
Age, yr	29.71 (13.60)
No. of years of education	15.64 (1.98)
Months since last concussion	29.71 (28.38)
No. of concussions	3.00 (1.66)
PHQ–9	8.78 (5.16)
	n (%)
Female	9 (64.28)
Ethnicity	
Hispanic or Latino	1 (7.14)
Not Hispanic or Latino	13 (92.85)
Race	
Asian	1 (7.14)
Black or African American	3 (21.40)
White	10 (71.42)

Note. PHQ–9 = Patient Health Questionnaire–9.

of 3.85 (*SD* = 0.25) on the Client Satisfaction Questionnaire–8. All feasibility criteria set a priori were met, with the exception of recruitment rate, which fell short of the intended benchmark by 17% (Figure 2).

Preliminary Effect

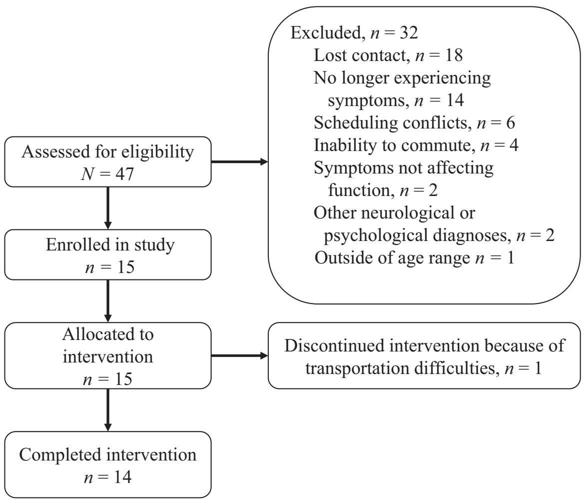
From pre- to postintervention, large improvements were demonstrated for performance (Hedge's g = 1.97) and satisfaction (Hedge's g = 2.59) scores for trained COPM goals (Table 3). Large improvement was also noted for satisfaction (Hedge's g = 0.81), and medium improvement was noted in performance levels (Hedge's g = 0.58) for untrained goals. Overall, larger gains were observed for goals that were directly trained compared with untrained goals. Large effects were noted for the affective and cognitive domains of the NSI (Hedge's gs = 1.14 and 0.85, respectively), sleep outcomes per the PSQI (Hedge's g = 0.87), and perceived executive function in daily life per the DEX (Hedge's g = 0.80).

Medium-sized effects were observed for visual symptoms in daily life (Hedge's g = 0.54). The sample demonstrated large gains in fluid cognitive abilities on the NIH Toolbox (Hedge's g = 1.08). Changes were negligible for functional cognition, as measured by the WCPA accuracy scores, time to completion, or efficiency; however, medium effects were present for time spent planning before the task (Hedge's g = 0.72) and for the number of rules followed during task performance (Hedge's g = 0.52).

Discussion

The primary goal of this research was to evaluate the feasibility of the CO-OP intervention in adults with

Figure 2. Study flow diagram.



PCS; secondarily, we sought to determine whether CO-OP elicited positive changes for concussive symptoms, functional cognition, and occupational performance outcomes. Much of the existing literature attempts to improve specific impairments experienced postconcussion and does not adequately account for how clients will engage in daily life activities in the presence of the persistent symptoms or for how participation in daily activities affects symptoms. In contrast, CO-OP is likely to be fitting for this population, because it teaches clients the problem-solving skills needed to grade activity participation and optimize quality of life despite symptoms.

Evaluation of feasibility is indicated for a completely novel intervention or when there is limited literature within a population (Bowen et al., 2009). Study findings supported the high acceptability of CO-OP for meeting the needs of adults with PCS, which is arguably one of the most key feasibility aspects. Participant satisfaction is also reflected in the high retention rate (93%) and adherence rate (100%), which further indicates that participants assigned value to continued study participation. Although the recruitment rate in this study did not meet the established benchmark threshold, compared with other rehabilitation trials, the present study had an adequate recruitment rate (32%; Geed et al., 2021). Collectively, these feasibility findings support an efficacy trial as a prudent next step for addressing occupational performance needs in adults with PCS.

The study sample demonstrated improvements in occupational performance, fluid cognitive abilities, executive functioning in daily life tasks, and affective and cognitive symptoms. Because this study was designed to test feasibility (e.g., small sample size, single group), effect sizes are not generalizable at the population level, but they do suggest that further research is warranted. Similar to samples in prior CO-OP literature (Dawson et al., 2009, 2013; McEwen et al., 2015), this

Table 3. Assessment Results

Outcome	M (SD)		Effect Size [95% CI]
	Baseline	Postassessment	
COPM			
Untrained goal performance	5.36 (2.59)	7.14 (1.61)	0.58 [0.03, 1.11]
Untrained goal satisfaction	5.43 (2.68)	7.86 (1.99)	0.81 [0.22, 1.38]
Trained goal performance	4.06 (1.42)	7.39 (1.14)	1.97 [1.06, 2.85]
Trained goal satisfaction	3.51 (1.47)	7.98 (1.38)	2.59 [1.48, 3.68]
NSI			
Affective	11.86 (4.70)	6.57 (3.94)	1.14 [0.46, 1.78]
Somatosensory	8.86 (2.66)	6.21 (4.54)	0.47 [−0.06, 0.98]
Cognitive	8.86 (2.82)	5.57 (3.90)	0.85 [0.25, 1.43]
Vestibular	2.79 (1.67)	2.29 (2.64)	0.22 [−0.29, 0.71]
PSQI global score	10.29 (3.73)	6.50 (3.80)	0.87 [0.27, 1.46]
COVD–QoL total score	47.71 (18.49)	36.57 (25.91)	0.54 [0.00, 1.07]
DEX total score	31.79 (10.15)	22.36 (9.06)	0.80 [0.21, 1.36]
NIH Toolbox Fluid Cognition T-score	43.64 (13.43)	55.00 (12.12)	1.08 [0.43, 1.71]
WCPA			
Accuracy	12.57 (2.34)	12.29 (1.86)	0.19 [−0.31, 0.68]
Planning time, in seconds	214.07 (427.58)	531.50 (663.03)	0.72 [0.15, 1.28]
Time for completion, in seconds	1,330.43 (416.98)	1,289.71 (560.41)	0.11 [−0.38, 0.61]
Efficiency	163.14 (110.56)	153.61 (82.86)	0.18 [−0.32, 0.67]
No. of rules followed	4.31 (0.95)	4.86 (0.36)	0.52 [−1.06, 0.04]

Note. CI = confidence interval; COPM = Canadian Occupational Performance Measure; COVD -QoL = College of Optometrists in Vision Development -Quality of Life Outcomes Assessment; DEX = Dysexecutive Questionnaire; NIH = National Institutes of Health; NSI = Neurobehavioral Symptom Inventory; PSQI = Pittsburgh Sleep Quality Index; WCPA = Weekly Calendar Planning Assessment.

sample experienced improvements in the performance of occupations that were directly trained and untrained; however, improvements on untrained goals were smaller in nature. It is expected that clients will demonstrate greater learning and skill improvement on goals that are directly addressed within rehabilitation, because this allows for actual skill repetition and problem-solving related to potential difficulties that could arise (Geusgens et al., 2007). Improvement on untrained goals requires more independence on behalf of the client; not only must a skill be retained, but the client also needs to recognize when and how to apply the skill within unlearned tasks and contexts. Therefore, although skill transfer is notoriously difficult, intentional structuring of learning experiences is needed to optimize skill transfer as much as possible.

Large effects were also present for fluid cognitive abilities and executive functioning abilities within daily life. Changes in fluid cognitive abilities suggest a potential downstream effect of the behavioral CO-OP intervention on cognitive processes. Prior studies have also found improvements on neuropsychological cognitive outcomes in the chronic stroke population after the CO-OP intervention (Wolf et al., 2016). Although cognitive processes are not the main target of strategy training interventions, gains in fluid cognition is not wholly unexpected, because it overlaps with many of the same cognitive processes engaged by CO-OP (e.g., problem-solving, awareness; Akshoomoff et al., 2013). Observed decreases in affective and cognitive symptoms in everyday life may be the result of participants' increased ability to problem-solve and self-modify participation in activities in a way that minimizes symptom elicitation.

Study findings should be interpreted with reasonable caution because of several factors. The majority of our sample were undergraduate and graduate college students and may not be representative of the population. Additionally, this study was conducted in a university research setting and may not fully reflect constraints that are present in a clinical environment.

Implications for Occupational Therapy Practice

The findings of this study have the following implications for occupational therapy practice:

- People with ongoing concussive symptoms perceive CO-OP as appropriate for addressing their daily life needs.

- The use of the CO-OP to address postconcussive symptoms appears to be feasible for occupational therapy; however, future efficacy trials are required.

Conclusion

Results suggest that, in the PCS population, CO-OP is feasible to administer and acceptable to the client. The occupation-based and client-driven nature of CO-OP aligns well with functional limitations and needs of those with PCS. CO-OP may improve occupational performance outcomes and PCS symptoms. Future work will verify the efficacy of CO-OP within PCS, including whether gains are retained over time.

Acknowledgments

We thank the University of Missouri Research Council for funding of this work and the participants for their engagement in this study.

References

Akshoomoff, N., Beaumont, J. L., Bauer, P. J., Dikmen, S. S., Gershon, R. C., Mungas, D., . . . Heaton, R. K. (2013). VIII. NIH Toolbox Cognition Battery (CB): Composite scores of crystallized, fluid, and overall cognition. *Monographs of the Society for Research in Child Development, 78,* 119–132. https://doi.org/10.1111/mono.12038

Attkisson, C. C., & Zwick, R. (1982). The Client Satisfaction Questionnaire: Psychometric properties and correlations with service utilization and psychotherapy outcome. *Evaluation and Program Planning, 5,* 233–237. https://doi.org/10.1016/0149-7189(82)90074-X

Bergersen, K., Halvorsen, J. Ø., Tryti, E. A., Taylor, S. I., & Olsen, A. (2017). A systematic literature review of psychotherapeutic treatment of prolonged symptoms after mild traumatic brain injury. *Brain Injury, 31,* 279–289. https://doi.org/10.1080/02699052.2016.1255779

Borenstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2021). *Introduction to meta-analysis.* Wiley.

Bowen, D. J., Kreuter, M., Spring, B., Cofta-Woerpel, L., Linnan, L., Weiner, D., . . . Fernandez, M. (2009). How we design feasibility studies. *American Journal of Preventive Medicine, 36,* 452–457. https://doi.org/10.1016/j.amepre.2009.02.002

Burgess, P. W., Alderman, N., Evans, J., Emslie, H., & Wilson, B. A. (1998). The ecological validity of tests of executive function. *Journal of the International Neuropsychological Society, 4,* 547–558. https://doi.org/10.1017/S1355617798466037

Buysse, D. J., Reynolds, C. F., 3rd, Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research, 28,* 193–213. https://doi.org/10.1016/0165-1781(89)90047-4

Carlozzi, N. E., Tulsky, D. S., Wolf, T. J., Goodnight, S., Heaton, R. K., Casaletto, K. B., . . . Heinemann, A. W. (2017). Construct validity of the NIH Toolbox Cognition Battery in individuals with stroke. *Rehabilitation Psychology, 62,* 443–454. https://doi.org/10.1037/rep0000195

Carpenter, J. S., & Andrykowski, M. A. (1998). Psychometric evaluation of the Pittsburgh sleep quality index. *Journal of Psychosomatic Research, 45,* 5–13. https://doi.org/10.1016/S0022-3999(97)00298-5

Choe, M. C., & Giza, C. C. (2015). Diagnosis and management of acute concussion. *Seminars in Neurology, 35,* 29–41. https://doi.org/10.1055/s-0035-1544243

Chu, S.-Y., Tsai, Y.-H., Xiao, S.-H., Huang, S.-J., & Yang, C.-C. (2017). Quality of return to work in patients with mild traumatic brain injury: A prospective investigation of associations among post-concussion symptoms, neuropsychological functions, working status and stability. *Brain Injury, 31,* 1674–1682. https://doi.org/10.1080/02699052.2017.1332783

Cicerone, K. D., & Kalmar, K. (1995). Persistent postconcussion syndrome: The structure of subjective complaints after mild traumatic brain injury. *Journal of Head Trauma Rehabilitation, 10,* 1–17. https://doi.org/10.1097/00001199-199510030-00002

Cicerone, K. D., Langenbahn, D. M., Braden, C., Malec, J. F., Kalmar, K., Fraas, M., . . . Ashman, T. (2011). Evidence-based cognitive rehabilitation: Updated review of the literature from 2003 through 2008. *Archives of Physical Medicine and Rehabilitation, 92,* 519–530. https://doi.org/10.1016/j.apmr.2010.11.015

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Erlbaum.

Cooksley, R., Maguire, E., Lannin, N. A., Unsworth, C. A., Farquhar, M., Galea, C., . . . Schmidt, J. (2018). Persistent symptoms and activity changes three months after mild traumatic brain injury. *Australian Occupational Therapy Journal, 65,* 168–175. https://doi.org/10.1111/1440-1630.12457

Dawson, D. R., Binns, M. A., Hunt, A., Lemsky, C., & Polatajko, H. J. (2013). Occupation-based strategy training for adults with traumatic brain injury: A pilot study. *Archives of Physical Medicine and Rehabilitation, 94,* 1959–1963. https://doi.org/10.1016/j.apmr.2013.05.021

Dawson, D. R., Gaya, A., Hunt, A., Levine, B., Lemsky, C., & Polatajko, H. J. (2009). Using the Cognitive Orientation to Occupational Performance (CO-OP) with adults with executive dysfunction following traumatic brain injury. *Canadian Journal of Occupational Therapy, 76,* 115–127. https://doi.org/10.1177/000841740907600209

Dawson, D. R., McEwen, S. E., & Polatajko, H. J. (2017). *Cognitive Orientation to Daily Performance in Occupational Therapy.* AOTA Press.

Geed, S., Feit, P., Edwards, D. F., & Dromerick, A. W. (2021). Why are stroke rehabilitation trial recruitment rates in single digits? *Frontiers in Neurology, 12,* 674237. https://doi.org/10.3389/fneur.2021.674237

Geusgens, C. A., Winkens, I., van Heugten, C. M., Jolles, J., & van den Heuvel, W. J. (2007). Occurrence and measurement of transfer in cognitive rehabilitation: A critical review. *Journal of Rehabilitation Medicine, 39,* 425–439. https://doi.org/10.2340/16501977-0092

Horn, J. L., & Cattell, R. B. (1966). Refinement and test of the theory of fluid and crystallized general intelligences. *Journal of Educational Psychology, 57,* 253–270. https://doi.org/10.1037/h0023816

Hunt, A. W., Paniccia, M., Mah, K., Dawson, D., & Reed, N. (2019). Feasibility and effects of the CO–OP Approach^{TM} in postconcussion rehabilitation. *American Journal of Occupational Therapy*, *73,* 7301205060.

Jaber, A. a. F., Hartwell, J., & Radel, J. D. (2019). Interventions to address the needs of adults with postconcussion syndrome: A systematic review. *American Journal of Occupational Therapy*, *73,* 7301205020.

King, P. R., Donnelle, K. T., Donnelly, J. P., Dunnam, W. G., Warner, G., Kittleson, C. J., … Meier, S. T. (2012). Psychometric study of the Neurobehavioral Symptom Inventory. *Journal of Rehabilitation Research & Development*, *49,* 879–888

Kjeldgaard, D., Forchhammer, H. B., Teasdale, T. W., & Jensen, R. H. (2014). Cognitive behavioural treatment for the chronic post-traumatic headache patient: A randomized controlled trial. *Journal of Headache and Pain, 15,* 81. https://doi.org/10.1186/1129-2377-15-81

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine, 16,* 606–613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x

Lancaster, G. A., Dodd, S., & Williamson, P. R. (2004). Design and analysis of pilot studies: Recommendations for good practice. *Journal of Evaluation in Clinical Practice, 10,* 307–312. https://doi.org/10.1111/j..2002.384.doc.x

Law, M. C., Baptiste, S., Carswell, A., McColl, M. A., Polatajko, H. J., & Pollock, N. (2014). *Canadian Occupational Performance Measure* (5th ed.). Canadian Association of Occupational Therapists.

Maples, W. C. (2000). Test-retest reliability of the College of Optometrists in Vision Development Quality of Life Outcomes Assessment. *Optometry, 71,* 579–585.

McCrory, P., Meeuwisse, W. H., Aubry, M., Cantu, R. C., Dvořák, J., Echemendia, R. J., . . . Turner, M. (2013). Consensus statement on concussion in sport—The 4th International Conference on Concussion in Sport, Zurich, November 2012. *Journal of Athletic Training, 48,* 554–575. https://doi.org/10.4085/1062-6050-48.4.05

McEwen, S., Polatajko, H., Baum, C., Rios, J., Cirone, D., Doherty, M., & Wolf, T. (2015). Combined cognitive-strategy and task-specific training improve transfer to untrained activities in subacute stroke: An exploratory randomized controlled trial. *Neurorehabilitation and Neural Repair, 29,* 526–536. https://doi.org/10.1177/1545968314558602

Meterko, M., Baker, E., Stolzmann, K. L., Hendricks, A. M., Cicerone, K. D., & Lew, H. L. (2012). Psychometric assessment of the Neurobehavioral Symptom Inventory-22: The structure of persistent postconcussive symptoms following deployment-related mild traumatic brain injury among veterans. *Journal of Head Trauma Rehabilitation, 27,* 55–62. https://doi.org/10.1097/HTR.0b013e318230fb17

Mozlin, R. (1995). Quality-of-life outcomes assessment. *Journal of Optometric Vision Development, 26,* 194–199.

Polatajko, H. J., Mandich, A. D., Missiuna, C., Miller, L. T., Macnab, J. J., Malloy-Miller, T., & Kinsella, E. A. (2001). Cognitive Orientation to daily Occupational Performance (CO-OP): Part III—The protocol in brief. *Physical and Occupational Therapy in Pediatrics, 20,* 107–123. https://doi.org/10.1300/J006v20n02_07

Polatajko, H. J., McEwen, S. E., Ryan, J. D., & Baum, C. M. (2012). Pilot randomized controlled trial investigating cognitive strategy use to improve goal performance after stroke. *American Journal of Occupational Therapy, 66,* 104–109. https://doi.org/10.5014/ajot.2012.001784

Poppelreuter, M., Weis, J., & Bartsch, H. H. (2009). Effects of specific neuropsychological training programs for breast cancer patients after adjuvant chemotherapy. *Journal of Psychosocial Oncology, 27,* 274–296. https://doi.org/10.1080/07347330902776044

Prince, C., & Bruhns, M. E. (2017). Evaluation and treatment of mild traumatic brain injury: The role of neuropsychology. *Brain Sciences, 7,* 105. https://doi.org/10.3390/brainsci7080105

Taylor, C. A., Bell, J. M., Breiding, M. J., & Xu, L. (2017). Traumatic brain injury–related emergency department visits, hospitalizations, and deaths—United States, 2007 and 2013. *MMWR. Surveillance Summaries, 66,* 1–16. https://doi.org/10.15585/mmwr.ss6609a1

Tickle-Degnen, L. (2013). Nuts and bolts of conducting feasibility studies. *American Journal of Occupational Therapy, 67,* 171–176. https://doi.org/10.5014/ajot.2013.006270

Toglia, J. (2015). *Weekly Calendar Planning Activity: A performance test of executive function.* AOTA Press.

Toglia, J., Lahav, O., Ben Ari, E., & Kizony, R. (2017). Adult age and cultural differences in performance on the Weekly Calendar Planning Activity (WCPA). *American Journal of Occupational Therapy*, *71,* 7105270010. https://doi.org/10.5014/ajot.2016.020073

Weiner, N. W., Toglia, J., & Berg, C. (2012). Weekly Calendar Planning Activity (WCPA): A performance-based assessment of executive function piloted with at-risk adolescents. *American Journal of Occupational Therapy, 66,* 699–708. https://doi.org/10.5014/ajot.2012.004754

Weintraub, S., Dikmen, S. S., Heaton, R. K., Tulsky, D. S., Zelazo, P. D., Bauer, P. J., . . . Gershon, R. C. (2013). Cognition assessment using the NIH Toolbox. *Neurology, 80*(Suppl. 3), S54–S64. https://doi.org/10.1212/WNL.0b013e3182872ded

Wilson, B. A., Alderman, N., Burgess, P. W., Emslie, H., & Evans, J. (1996). *Behavioural assessment of the dysexecutive syndrome.* Thames Valley Test Company.

Wolf, T. J., Polatajko, H., Baum, C., Rios, J., Cirone, D., Doherty, M., & McEwen, S. (2016). Combined cognitive-strategy and task-specific training affects cognition and upper-extremity function in subacute stroke: An exploratory randomized controlled trial. *American Journal of Occupational Therapy*, *70,* 7002290010. https://doi.org/10.5014/ajot.2016.017293

Wrzus, C., Hänel, M., Wagner, J., & Neyer, F. J. (2013). Social network changes and life events across the life span: A meta-analysis. *Psychological Bulletin, 139,* 53–80. https://doi.org/10.1037/a0028601

Zemek, R., Barrowman, N., Freedman, S. B., Gravel, J., Gagnon, I., McGahern, C., . . . Osmond, M. H.; Pediatric Emergency Research Canada (PERC) Concussion Team. (2016). Clinical risk score for persistent postconcussion symptoms among children with acute concussion in the ED. *JAMA, 315,* 1014–1025. https://doi.org/10.1001/jama.2016.1203

Anna E. Boone, PhD, MSOT, OTR/L, is Assistant Professor, Department of Occupational Therapy, University of Missouri, Columbia; booneae@umsystem.edu

Casey Perry, BHS, is Research Assistant, Department of Occupational Therapy, University of Missouri, Columbia.

Whitney L. Henderson, OTD, MOT, OTR/L, is Associate Clinical Professor, Department of Occupational Therapy, University of Missouri, Columbia.