



AOTA Critically Appraised Topics and Papers Series
Traumatic Brain Injury

**A product of the American Occupational Therapy Association's
Evidence-Based Literature Review Project*

CRITICALLY APPRAISED PAPER (CAP)

Focused Question

What is the evidence for the effect of interventions to address cognitive/perceptual functions (attention, memory, executive functions) on the occupational performance for persons with traumatic brain injury (TBI)?

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Park, N. W., & Ingles, J. L. (2001). Effectiveness of attention rehabilitation after an acquired brain injury: A meta-analysis. *Neuropsychology, 15*, 199-210. Also published in 2000 in *Brain & Cognition, 44*, 1-18.

PROBLEM STATEMENT (JUSTIFICATION OF THE NEED FOR THE STUDY)

State the problem the authors are investigating in this study.

Deficits of attention greatly impede the recovery of other cognitive and functional abilities. Impaired attention is associated with unlikelihood of return to work. The question is whether rehabilitation should aim to restore damaged cognitive function through repetitive exercises or drills or whether rehabilitation should help patients develop compensatory alternative ways of performing tasks through specific skill training.

RESEARCH OBJECTIVE(S)

List study objectives.

Examine the efficacy of current attention rehabilitation after an acquired brain injury meta-analytically. Identify methodological factors that may contribute to the variability in improvement reported in the literature. Evaluate whether direct-retraining and specific-skill programs differed in their effectiveness.

Describe how the research objectives address the focused question.

Provides a high level of evidence as to whether the interventions for attention deficits following traumatic brain injury (TBI) are effective.
Because this is a meta-analysis review, much of this worksheet cannot be completed (sections noted with *). However, see Results, Conclusions, and Clinical Implications for discussion of how this review contributes to the evidence-based review question.

DESIGN TYPE:

Meta-analysis

Level of Evidence:

I

Limitations (appropriateness of study design):

Was the study design type appropriate for the knowledge level about this topic? *If no, explain.*

Yes

No

SAMPLE SELECTION

How were subjects selected to participate? Please describe.

Cited in MEDLINE (1966–June 1997) and PsychLIT (1974–June 1997) or referred to classic articles in the Science Citation Index. Ancestry search of references of retrieved studies.

Inclusion Criteria

Studies included had to evaluate the effectiveness of interventions for attentional disorders following brain damage. The treatment had to involve practice performing either cognitive exercises or specific skills that critically require attention. Participants in the studies had to be adults with an acquired brain injury following stroke, TBI, or surgical lesion. The specific effects of the attentional intervention could be determined when the treatment was part of a more comprehensive rehabilitation program. At least one quantitative outcome measure was used and results had sufficient detail for effect size estimates to be computed. Outcome measures had to differ from training measures (excluded 6 studies).

Exclusion Criteria

Studies that focused on the treatment of hemi-inattention.

Sample Selection Biases: *If yes, explain.*

Volunteers/Referrals

Yes

No

Attention

Yes

No

Others (list and explain):

*** SAMPLE CHARACTERISTICS**

N= 30 studies that involved 359 participants and yielded 481 effect size estimates

% Dropouts

(%) Male

(%) Female

Ethnicity

Disease/disability diagnosis

Stroke, TBI, brain injury secondary to surgical procedure. Many patients with TBI had severe injury (posttraumatic amnesia mean = 44.7 days, standard deviation = 27.9 days, n = 4; duration of coma mean = 29.8 days, standard deviation = 22.8 days, n = 10).

Check appropriate group:

| | | | | |
|-----------------|-------------------|--------------------|---------------------|---------------------|
| <20/study group | 20–50/study group | 51–100/study group | 101–149/study group | 150–200/study group |
|-----------------|-------------------|--------------------|---------------------|---------------------|

Sample Characteristics Bias: *If no, explain.*

If there is more than one study group, was there a similarity between the groups?

Yes

No

Were the reasons for the dropouts reported?

Yes

No

* **INTERVENTION(S)**—Included are only those interventions relevant to answering the evidence-based question.

Add groups if necessary

Group 1

| | |
|-------------------|---|
| Brief Description | 67% of studies included both auditory and visual exercises; 83% of studies specified that the tasks were graduated in difficulty; 77% of the studies indicated that feedback on training performance was provided. Number of training tasks varied (mean = 7.7, standard deviation = 8.7, n = 23), with 50% of studies providing 5 or more tasks. 89% of programs had a component in which speeded or paced performance was encouraged. |
| Setting | |
| Who Delivered? | In 50% of studies, by computer |
| Frequency? | |
| Duration? | Mean = 31.2 hours (standard deviation = 32.7 hrs) |

Intervention Biases: *Explain, if needed.*

Contamination

Yes

No

Co-intervention

Yes

No

Coding of Studies:

1. Purpose of study to retrain attention or to improve a specific skill. To qualify as a direct-retraining study, practice performing a series of repetitive, attention-demanding exercises had to be provided. To qualify as a specific-skill study, practice performing a functional skill or a closely related skill that critically required attention (e.g., driving) had to be provided. 26 = direct-retraining; 4 = specific-skill studies.
2. Outcome measures of attention were coded as focus/execute (tests of perceptual or motor speed); sustain (tests of vigilance or sustained concentration); encode (tests of short-term storage or numerical manipulation of information); or other (working memory, picture completion, mental control, simple reaction time, choice reaction time, divided attention, time estimation).
3. Outcome measures of performance of functional skills were: activities of daily living, driving, attention behavior on a specific task (e.g., frequency of attention slips in reading).
4. Type of effect size: pretest–posttest only design or pretest–posttest with control design.

- 5. Characteristics of participants: age, time post-onset, etiology, severity of brain damage
- 6. Characteristics of training: number of hours, setting, modality, content, speed, difficulty, administration mode, and feedback

Timing

Yes

No

Site

Yes

No

Use of different therapists to provide intervention

Yes

No

*** MEASURES AND OUTCOMES**—Included are measures relevant to answering the focused question.

Name of measure:

Hedge’s g, converted into d; aggregate results reported in terms of weighted mean estimates (d_w), calculated by weighting each d by the reciprocal of its variance (more reliable effect sizes were thus weighted more heavily).

Outcome(s) measured (what was measured?):

Hedge’s g = difference between two means divided by the appropriate standard deviation

Is the measure reliable (as reported in article)?

Yes

No

NR

Is the measure valid (as reported in article)?

Yes

No

NR

How frequently was the measure used for each group in the study?

Measurement Biases

Were the evaluators blinded to treatment status? *If no, explain.*

Yes

No

Recall or memory bias *If yes, explain.*

Yes

No

Others (list and explain):

Limitations (appropriateness of outcomes and measures) *If no, explain.*

Did the measures adequately measure the outcome(s)?

Yes

No

RESULTS

List results of outcomes relevant to answering the focused question

Include statistical significance where appropriate ($p < 0.05$)

Include effect size if reported

Results showed that all measures of cognitive function (attention, learning and memory, and other) improved significantly when assessed by pretest–posttest only type of estimate; however, no measure of cognitive function improved significantly when measured by the pretest–posttest with control estimates. The effect sizes were all $< .15$ ¹. The first finding may be attributed to practice effects rather than true effects of the interventions because there was an improvement seen from before treatment to after treatment (practice) in studies without control groups (less controlled studies). For the studies with control groups (more controlled design), the effects of treatment were not evident on cognitive functions.

The pretest–posttest with control effect size estimates for the different measures of specific skills (e.g., activities of daily living, driving, attention behavior) were all $> .49$, and driving and attention behavior improved significantly after training.

In the 12 studies that investigated the efficacy of direct retraining with control condition, 6 reported no statistically significant improvement after training and 6 reported statistically significant improvement in one or more measures. The pattern of improvement in this latter set of studies seemed to be more attributable to the acquisition of specific skills rather than to retraining of attention.

Was this study adequately powered (large enough to show a difference)? *If no, explain.*

Yes

No

Were appropriate analytic methods used? *If no, explain.*

Yes

No

Were statistics appropriately reported (in written or table format)? *If no, explain.*

Yes

No

¹d value of 0.20 is a small effect, 0.50 is a medium effect, and 0.80 is a large effect.

CONCLUSIONS

State the authors' conclusions that are applicable to answering the evidence-based question.

Several lines of evidence showed that direct retraining of attention produced only small, statistically nonsignificant improvements in performance in all general measures of cognitive function and in all specific measures of attention when improvement was determined using pretest–posttest with control effect size estimates. Therefore, support for the hypothesis that direct retraining can restore or strengthen damaged attentional function was not found in the reviewed studies.

Effect sizes derived from studies without a control group were consistently much larger than those from studies with a control group for the different measures of cognitive function and types of attention. These findings strongly suggest that the larger effect sizes in the pretest–posttest only studies are attributable to the effects of practice on the outcome measures and not to other associated factors.

The direct retraining methods used in the reviewed studies produced only small, statistically nonsignificant improvements in performance, whereas the few studies that attempted to rehabilitate specific skills requiring attention showed statistically significant improvements after training and had considerably larger effect sizes.

The results of this meta-analysis demonstrate that acquired deficits of attention are treatable. The results suggest that learning that occurs as a function of training is specific and does not generalize to tasks that differ considerably from those used in training. How to best train a person with brain damage needs study. A central challenge for rehabilitation professionals will be to develop new, more efficient training procedures.

Were the conclusions appropriate for the study design (level of evidence)? *If no, explain.*

Yes

No

Were the conclusions appropriate for the statistical results? *If no, explain.*

Yes

No

Were the conclusions appropriate given the study limitation and biases? *If no, explain.*

Yes

No

IMPLICATIONS FOR OCCUPATIONAL THERAPY

This section provides guidance about clinical practice, program development, and other implications of the study findings as they relate to the focused question.

Training in tasks required of a person's daily life is more likely to result in improved performance than attempts to retrain attentional skills generally. This conclusion supports the advocated practice of occupational therapy in which emphasis is placed on training of tasks and activities of everyday occupational performance.

This work is based on the evidence-based literature review completed by Catherine Trombly, ScD, OTR/L, FAOTA.

CAP Worksheet adapted from: Critical Review Form – Quantitative Studies ©Law, M., Stewart, D., Pollack, N., Letts, L., Bosch, J., & Westmorland, M., 1998, McMaster University. Used with permission.

For more information about the Evidence-Based Literature Review Project, contact the American Occupational Therapy Association, 301-652-6611, x 2052.



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