



## 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 sensory stimulation on the arousal level of persons in coma or persistent vegetative state after traumatic brain injury (TBI)?**

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Johnson, D. A., Roethig-Johnson, K., & Richards, D. (1993). Biochemical and physiological parameters of recovery in acute severe head injury. Responses to multisensory stimulation. *Brain Injury*, 7, 491–499.

#### **PROBLEM STATEMENT (JUSTIFICATION OF THE NEED FOR THE STUDY)**

- There is no consistent input of purposeful stimulation during the coma period.
- A controversy exists regarding whether to protect patients from stimulation to avoid overloading the central nervous system (CNS) or to use stimulation to hasten recovery.
- Severe head injury may create a state similar to sensory deprivation.
- Without patterned input, the undamaged areas of the CNS will be deprived of normal function and thus incapable of supporting behavior.
- Environmental stimulation may reverse behavioral and physiological deficits arising after some brain lesions in some populations.
- There is little evidence to indicate whether claims for coma arousal have any valid basis. There is a need to use valid and sensitive measures of functioning to determine whether arousal occurs.

State the problem the authors are investigating in this study.

Whether sensitive physiological measures can detect effects of multisensory stimulation intervention on the arousal levels of patients with severe brain-injuries.

## RESEARCH OBJECTIVE(S)

List study objectives.

- To investigate the efficacy of a program of multisensory stimulation for patients with severe, diffuse traumatic brain injury (TBI) while they are in the intensive care unit.
- To measure outcome in terms of physiological and biochemical changes, as well to observe the response.

Describe how the research objectives address the focused question.

The first objective addresses the focused question.

## DESIGN TYPE:

RCT (randomized controlled trial)

## 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.

- Consecutive admissions to the intensive care unit of a tertiary level neurosciences unit.
- Randomly assigned to group.

## Inclusion Criteria

- Glasgow Coma Scale (GCS) < 8
- ICD codes 800–804, 850–854

## Exclusion Criteria

- History of neurological or psychiatric disorders
- Alcohol or drug abuse
- Previous head injury

Sample Selection Biases: If yes, explain.

Volunteers/Referrals

Yes

No

Attention

Yes

No   Possibly. There was a difference in duration of observation between the treatment group and the nontreatment group.

Others (list and explain):

**SAMPLE CHARACTERISTICS**

N= 14

# / % Dropouts  8 / 57% (died)

# / % Male  14/ 100% # / % Female  0/0%

Ethnicity  White

Disease/disability diagnosis  Severe acceleration-deceleration head injury

Check appropriate group:

<20/study group <input checked="" type="checkbox"/>	20–50/study group	51–100/study group	101–149/study group	150–200/study group
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Sample Characteristics Bias: If no, explain.

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

Yes  Overall yes, except more of the nontreatment group died and the nontreatment group was monitored approximately half the duration of the treatment group, suggesting differences in severity. No differences were tested statistically.

No

Were the reasons for the dropouts reported?

Yes  ✓ Death

No

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

Add groups if necessary

Group 1: Treatment (T)

Brief Description	All senses were vigorously stimulated using nonfamiliar stimuli; order of stimulus presentation was randomized
Setting	Intensive care unit (ICU)—stable temperature and lighting; no interruptions
Who Delivered?	Not reported
Frequency?	20 minutes per day
Duration?	Mean of 8.1 days $\pm$ 6.4 days

Group 2: Nontreatment (NT)

Brief Description	No sensory stimulation intervention
Setting	Same as treated
Who Delivered?	N/A
Frequency?	N/A
Duration?	Observations taken for a mean of 3.7 $\pm$ 2.1 days

Intervention Biases: *Explain, if needed.*

Contamination

Yes

No

Co-intervention

Yes

No

Timing

Yes

No

Site

Yes

No

Use of different therapists to provide intervention

Yes

No

NR

NR = Not reported.

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

Name of measure:

Clinical observations

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

GCS, state of ventilation, spontaneous eye movements, oculocephalic response, oculo-vestibular response

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?

Daily for the duration of the stay in ICU or the ward (range of 1–18 days; mean of 5.9 days)

Name of measure:

Physiological and biochemical measures

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

Heart rate, skin conductance, blood and urine samples

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?

Daily, pre- and posttreatment while in the ICU. When in the ward, once per day for biochemical; heart rate and skin conductance were not monitored outside of the ICU.

#### Measurement Biases

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

Yes

No

NR

Recall or memory bias *If yes, explain.*

Yes

No

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

Did the measures adequately measure the outcome(s)?

Yes

No  Measures were of cellular and basic behavioral responses; they gave no indication of functional recovery.

## RESULTS

List results of outcomes relevant to answering the focused question

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

Include effect size if reported

The outcome for the GCS was not reported. Only 3-methoxy, 4-hydroxyphenyglycol showed a significant difference in stimulation effect between the two groups ( $F = 8.54$ ,  $p < 0.006$ ). It rose in the treatment group and declined in the nontreatment group. The authors could not explain the meaning of this finding. There was no significant difference between groups for hear rate ( $F = .70$ ,  $p < 0.499$ ) or skin conductance ( $F = 2.52$ ,  $p < 0.092$ ).

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

Yes

No  Small heterogeneous sample; large attrition rate in both groups

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

Yes

No

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

Yes

No

## CONCLUSIONS

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

The results give no unequivocal support for the effectiveness of multisensory stimulation in the acute stage of recovery after severe diffuse TBI (p. 496). The authors were unable to confirm that early multisensory stimulation is of any benefit to the patient (p. 496).

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.

This study has no implications for occupational therapy because the outcome measures gave no indication of functional recovery.

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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