Treatment of unawareness of deficits in patients with acquired brain injury: a systematic review

Citation for published version (APA):

Document status and date:
Published: 01/01/2014

DOI:
10.1097/01.HTR.0000438117.63852.b4

Document Version:
Publisher's PDF, also known as Version of record

Document license:
Taverne

Please check the document version of this publication:
• A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
• The final author version and the galley proof are versions of the publication after peer review.
• The final published version features the final layout of the paper including the volume, issue and page numbers.

Link to publication

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

• Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the “Taverne” license above, please follow below link for the End User Agreement:
www.umlib.nl/taverne-license

Take down policy
If you believe that this document breaches copyright please contact us at:
repository@maastrichtuniversity.nl
providing details and we will investigate your claim.

Download date: 17 Sep. 2023
Treatment of Unawareness of Deficits in Patients With Acquired Brain Injury: A Systematic Review

Anne-Claire Schrijnemaekers, MSc; Sanne M. J. Smeets, MSc; Rudolf W. H. M. Ponds, PhD; Caroline M. van Heugten, PhD; Sascha Rasquin, PhD

Objective: To review and evaluate the effectiveness and methodological quality of available treatment methods for unawareness of deficits after acquired brain injury (ABI). Methods: Systematic literature search for treatment studies for unawareness of deficits after ABI. Information concerning study content and reported effectiveness was extracted. Quality of the study reports and methods were evaluated. Results: A total of 471 articles were identified; 25 met inclusion criteria. Nine of higher quality: 2 randomized controlled trials, 5 single case experimental designs, 1 single-case design with pre- and posttreatment measurement, and 1 quasi-experimental controlled design. Overall, interventions consisted of multiple components including education and multimodal feedback on performance. Effect sizes ranged from questionable to large. Conclusion: Patients with ABI may improve their awareness of their disabilities and possibly attain a level at which they personally experience problems when they occur. At present, because of lack of evidence, no recommendation can be made for treatment approaches for persons with severe impairment of self-awareness in the chronic phase of ABI. We recommended developing and evaluating theory-driven interventions specifically focused on disentangling the components of treatment that are successful in improving awareness. High-quality intervention studies are urgently needed using controlled designs (eg, single-case experimental designs, randomized controlled trials) based on a theoretic perspective with a detailed description of the content of the intervention and suitable outcome measures. Key words: awareness, brain injuries, intervention studies, literature review, rehabilitation

Acquired Brain Injury (ABI) can lead to impairments in physical, emotional, cognitive, and social abilities. Diminished awareness of these impairments—a well-known clinical problem following ABI—is seen as compromise of the ability to appraise one’s strengths and weaknesses and the implications for life, presently and in the future.1,2 Reported prevalence ranges from 30% to 97%, depending on multiple factors including the measurement instrument used, severity of injury, and amount of time since injury.1,3–9 Areas of diminished functioning about which patients may lack awareness include cognition, behavior, and interpersonal skills as well as the effects their behavior have on others.10 Frontal lobe dysfunction has often been linked to impaired awareness of deficits, but currently there is no clinical consensus regarding the pathogenesis underlying this phenomenon.10–12

The concept of impaired awareness can be divided into different types of impairment. A practical model defined by Crosseon et al13 outlines a 3-stage hierarchical model in which intellectual awareness represents the ability to understand that a function is impaired or to understand the complications caused by the impairment. Emergent awareness is the ability to recognize a problem when it is occurring, which requires the person to reach a level of intellectual awareness similar to that before injury. Anticipatory awareness is the ability to foresee that a problem will occur as a result of having some type of deficit. Other models concerning impaired awareness of deficits after ABI also describe 3 components of awareness and show considerable overlap.1,14–18

Author Affiliations: Rehabilitation Centre Adelante, Department of Brain Injury, Hoensbroek (Ms Schrijnemaekers and Drs Rasquin, and Ponds); Adelante knowledge centre, Hoensbroek (Dr Rasquin); School for Mental Health and Neuroscience (MHcNS), Department of Psychiatry and Neuropsychology, Maastricht University (Ms Smeets and Drs Ponds and van Heugten); Department of Medical Psychology, Maastricht University Medical Center (MUMC), Maastricht (Dr Ponds); and Department of Neuropsychology and Psychopharmacology, Faculty of Psychology and Neuroscience, Maastricht University (Dr van Heugten), The Netherlands.

Supplemental digital content is available for this article. Direct URL citation appears in the printed text and is provided in the HTML and PDF versions of this article on the journal’s Web site (www.headtraumarehab.com).

The authors declare no conflicts of interest.

Corresponding Author: Anne-Claire Schrijnemaekers, MSc, Rehabilitation Centre Adelante, Department of Brain Injury, Zandbergweg 111, 6432 CC Hoensbroek, The Netherlands (a.schrijnemaekers@adelante-zorggroep.nl).

DOI: 10.1097/HTR.0000438117.63852.b4
2 models,\textsuperscript{16,17} the psychological factor of denial is prominent. Taken together, these models include cognitive components (basic cognitive abilities to perceive, understand, and recognize situations), higher-order cognitive components (self-regulation and anticipation), and a psychological component (with denial on 1 side of the spectrum and acceptance on the other).

The implications associated with impaired awareness of deficits include diminished motivation for treatment (as the patient may not recognize or acknowledge the need for intervention),\textsuperscript{19} worse treatment adherence and performance,\textsuperscript{20,21} and an unfavorable short- and long-term employment outcome.\textsuperscript{22,23} By contrast, patients with more intact intellectual awareness achieve better independent living skills.\textsuperscript{24} Herein lies the challenge of treating patients with awareness problems.

Currently, there are no well-established clinical guidelines for treating unawareness of deficits after ABI,\textsuperscript{25} despite an array of studies that have evaluated different treatments to improve awareness of deficits. The objective of this article is to review the available treatment methods for impaired awareness and to provide a comprehensive summary of their effectiveness. The current review differs from previous reviews\textsuperscript{26–28} in that it has no restriction on the type of brain injury, intervention, study design, and number of participants; it comprises a broad spectrum of research of interventions that aim to improve awareness of deficits. The following questions are addressed: (i) which interventions have been investigated and what are their specific characteristics and (ii) how effective were these interventions?

\section*{METHODS}

\subsection*{Selection of articles}

A systematic literature search was performed using the electronic databases PsycINFO (1887 to October 2012), PubMed (1953 to October 2012), Embase (1989 to October 2012), The Cochrane Library (1890 to October 2012), and PsychBITE (1940 to October 2012). Free text words as well as index terms were combined. The search strategy used 3 categories: diagnosis (ABI), the specific condition (unawareness of deficits), and intervention. The search was limited to human studies (adolescents and adults) and articles published in peer-reviewed journals. See Table, Supplemental Digital Content 1, available at http://links.lww.com/JHTR/A87, for a detailed description of the specific search strategies used for each database.

Articles were selected if they described an intervention study for improving awareness of deficits in adults (16 years or older) with ABI, and if they had a study design with at least pre- and postintervention measurements. Studies published in languages other than English, Dutch, German, or French were excluded. Furthermore, studies were excluded if the primary aim of the intervention was related to visuospatial or somatosensory neglect. Neglect is based on impaired mechanisms of visual attention and, hence, represents a specific demarcated area that lies outside the scope of this review.

Studies were independently selected on the basis of title, abstract, and full text by the first 2 authors (A.C.S. and S.S.). In cases of disagreement, a third author (S.R.) made the final decision. The reference lists of the selected articles were examined for other potentially relevant studies. If appropriate, the specific study cited was tracked down and included in the review.

\subsection*{Data extraction}

Data extraction was based on the checklist of items to consider from the Cochrane manual,\textsuperscript{29} together with data extraction methods from similar reviews.\textsuperscript{30,31} The following study characteristics were extracted from the articles: design of the study, number of patients, type of intervention, effects on the awareness, and functional outcome measures. The overall effect of each intervention was summarized as positive (+), no effect (0), or negative (−).\textsuperscript{32} Results were considered to be positive when statistically significant at the \( P < .05 \) level. If no statistical test results were available, the interpretation of the effect was based on the interpretations made by the authors of the study in question.

In addition, we calculated effect sizes. For independent group studies (eg, RCTs), the standardized difference between means, Hedge’s \( g \), was calculated where possible (effect size = \( \frac{\text{Mean}_{\text{experimental group, post measurement}} - \text{Mean}_{\text{experimental, pre}}}{\text{SD}_{\text{experimental, pre}}} \)). An effect size of 0.2 is considered small, 0.5 medium, and 0.8 large.\textsuperscript{34} For single-case studies (eg SCED), the percentage of nonoverlapping data (PND)\textsuperscript{35} was used as a measure of effect size. For calculating the PND, the highest data point in the baseline phase needs to be identified. The PND is then determined by calculating the percentage of data points during the intervention phase exceeding this level. A PND smaller than 50\% reflects minimally effective treatment, 50\% to 70\% reflects questionable effectiveness, 70\% to 90\% is fairly effective and more than 90\% reflects a highly effective treatment. Although the PND is often used to determine the effect of treatment in single-case studies, this method is sensitive to floor/ceiling effects and lacks discrimination ability for highly effective treatments (eg, cannot detect slope changes). This should be taken into account when interpreting the PND.

Further data extractions focused on both patient and intervention characteristics. Patient characteristics included age and sex, in- or outpatient setting, etiology...
of ABI, time since onset, severity of ABI, and baseline functioning at the beginning of treatment. The following intervention characteristics were extracted: aim(s) of intervention, content of intervention, disciplines involved, and duration/intensity of the intervention.

Quality assessment

Studies were divided into high- and moderate-quality studies following predefined criteria. Studies were considered to be of high quality if they used an independent groups pre-post design (ie, patients were assigned to treatment and control groups and assessed pre- and posttreatment) or if they used single subject designs with multiple pre- and posttreatment measurements (ie, single-case experimental designs). Studies were considered to be of moderate quality or less if they did not fulfill the aforesaid criteria (ie, single group pre-post designs or single-case designs with 1 pre- and posttreatment measurement). The results of the high-quality studies are thoroughly described. The results of the moderate-quality studies are described in summary. To accurately provide a critical appraisal of the validity and applicability of the reviewed results, treatments were assessed using the CONSORT 2010 checklist of information that is to be included when reporting an RCT36 and the CONSORT Statement extension for nonpharmacologic trials.37

RESULTS

The literature search identified 471 articles that were evaluated according to the aforesaid inclusion criteria. Ultimately, 25 articles met the full inclusion criteria and were used for this review (see Figure 1). Reasons for exclusion included the following: the studies did not address awareness of deficits (eg, studies of awareness of risk factors for specific diseases in the normal population), the studies primarily focused on visuospatial or somatosensory neglect, or the studies were not intervention studies.

Of the 25 included studies, 2 were RCTs,25,38 6 were single-case experimental designs,39–44 1 was a quasi-experimental controlled trial,45 10 were uncontrolled pre-post measurements,6,46–54 and 6 were case studies.55–60 Nine studies fulfilled the criteria to be considered high quality and are further presented in the tables. Studies of moderate quality are briefly described in the text.

Study characteristics

High-quality studies

The study characteristics of the 9 high-quality studies are described in Table 1. The high-quality studies consisted of single-case experimental designs (N = 4),39–41,43 RCTs (N = 2),25,38 a quasi-experimental controlled design (N = 1),45 and single-case designs with multiple pre- and posttreatment measurements (N = 2).42,44 The number of participants in the experimental groups ranged from 1 to 17 with a mean of 7. Three studies reported follow-up measurements.42–44

Awareness was measured with the Awareness Questionnaire (AQ) discrepancy score (the difference in scores between the patient and an informant; N = 4),39–41,43 the AQ patient score (N = 1),45 the self-awareness of deficit interview (SADI; N = 2),25,39 the self-regulation skills interview (SRSI; N = 3),38,42,44 the assessment of awareness of disabilities (N = 2),38,41 the Competency Rating Scale difference score (N = 1),43 the difference in predicted versus actual scores on a memory test (N = 1),40 and the percentage of correct answers on ABI questions (N = 1).43

Figure 1. Flowchart of the selection of articles.

www.headtraumarehab.com
<table>
<thead>
<tr>
<th>Author/s country</th>
<th>N (E/C)</th>
<th>Intervention</th>
<th>Design/FU</th>
<th>Awareness outcome (E: score/C: score)</th>
<th>Other Outcome Measures (E: score/C: score)</th>
<th>Effect on awarenessb (ES)</th>
<th>Effect on other outcomes (ES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chandrashekar and Benshoff USA</td>
<td>17/19</td>
<td>Quality of Life and Awareness Training (QLAT)</td>
<td>Quasi experimental controlled design</td>
<td>AQ: E: pre 41.88; post 44.65; 4.1% change, ns C: pre 45.68; post 50.58; 7.2% change, ns</td>
<td>Wisconsin HSS: E: pre 166.87; post 164.65; −1% change, ns C: pre 167.92; post 161.45; −2.7% change, ns</td>
<td>0 (−) statistical</td>
<td>0 (−) statistical</td>
</tr>
<tr>
<td>Cheng and Man Hong Kong</td>
<td>11/10</td>
<td>Awareness Intervention Program</td>
<td>RCT</td>
<td>SADI: E: pre 5.5; post 0.07; −60.3% change, P = .003 C: pre 5.1; post 3.6; −17% change, P = .011</td>
<td>FIM: E: pre 67; post 104.8; 30% change, P = .003 C: pre 75.3; post 100; 19.6% change, P = .05 Lawton IADL: E: pre 4.4; post 14.3; 36.7%, P = .003 C: pre 4.6; post 9.6; 18.5% change, P = .012</td>
<td>+ (1.7) statistical</td>
<td>+ FIM (0.5), Lawton IADL (0.8) statistical</td>
</tr>
<tr>
<td>Goverover et al USA</td>
<td>10/10</td>
<td>Occupation-based training protocol embedded within the practice of IADLs</td>
<td>Single blind RCT</td>
<td>AAD: E: pre 14.6; post 16.7; 7.2% change C: pre 16.5; post 14.7; −6.2% change, interaction ns SRSI: E: pre 7.4a; post 6.2; −12% change C: pre 7.4b; post 7.7; 3% change, interaction P &lt; .001 AMPS process (Rasch): E: pre 1.1; post 1.51 C: pre 1.5; post 1.76; interaction ns CIQ: E: pre 13.9; post 13.3; −2% change C: pre 14.7; post 13.6; −3.7% change, interaction ns</td>
<td>+ SRSI (1.0) 0 AAD (0.5), AQ (0.2) statistical</td>
<td>+ AMPS process (1.0) 0 AMPS motor (0.1) 0 CIQ (0.0) statistical</td>
<td></td>
</tr>
</tbody>
</table>

(continues)
<table>
<thead>
<tr>
<th>Author/s</th>
<th>country</th>
<th>N (E/C)</th>
<th>Intervention</th>
<th>Design/FU</th>
<th>Awareness outcome (E: score/C: score)</th>
<th>Other Outcome Measures (E: score/C: score)</th>
<th>Effect on awarenessb (ES)</th>
<th>Effect on other outcomes (ES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownsworth et al</td>
<td>Australia</td>
<td>1</td>
<td>Metacognitive contextual intervention</td>
<td>SCED</td>
<td>SADI pre 6; post 5; −11.1% change, nt AQ-Discrepancy pre 18; post 10; −4.7 % change, nt</td>
<td>Error frequency (observation): cooking pre (average baseline) 21; during treatment period (average) 11.8; maintenance (average) 11; 44% change (baseline-treatment), 6.7% change (treatment-maintenance) volunteer work pre (average baseline) 12.3; during treatment period (average) 7.5; 39% change</td>
<td>0 (−) observed</td>
<td>+ error frequency (PND 100%) observed</td>
</tr>
<tr>
<td>Rebmann and Hannon</td>
<td>USA</td>
<td>3</td>
<td>Feedback</td>
<td>SCED</td>
<td>Differences between subjects’ predicted and actual scores on the Brief Multiparametric Memory Test: scores not reported, only graphs, nt.</td>
<td>+ (PND 65%) observed</td>
<td>. . .</td>
<td>. . .</td>
</tr>
<tr>
<td>Tham et al</td>
<td>Sweden</td>
<td>4/0</td>
<td>Feedback Task specific</td>
<td>SCED A1-B-A2</td>
<td>AAD: no scores reported No. 1, no. 2: stable baseline, clinically meaningful change in level of awareness between A1 and B, maintained changes in the A2 phase</td>
<td>Unilateral neglect (letter cancelation and baking tray task) decreased in three participants Sustained attention improved in 2 participants.</td>
<td>+ (PND 100%) Clinically meaningful change (logits, statistical)</td>
<td>+ ADL ability (PND 92%-100%) 0 unilateral neglect (PND 67%-83%) sustained attention (PND 67%) observed (continues)</td>
</tr>
<tr>
<td>Author/s country</td>
<td>N (E/C)</td>
<td>Intervention</td>
<td>Design/FU</td>
<td>Awareness outcome (E: score/C: score)</td>
<td>Other Outcome Measures (E: score/C: score)</td>
<td>Effect on awarenessb (ES)</td>
<td>Effect on other outcomes (ES)</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>---------</td>
<td>--------------</td>
<td>-----------</td>
<td>----------------------------------------</td>
<td>--------------------------------------------</td>
<td>--------------------------</td>
<td>------------------------------</td>
<td></td>
</tr>
<tr>
<td>Toglia et al44</td>
<td>4</td>
<td>Multicontext approach</td>
<td>Single subject with baseline (2 subjects) pre (2 subjects) and post/1 mo FU pre1 = 4 wk before pre2 = just before post1 = immediately after post2 = 4 wk after</td>
<td>AQ-Discrepancy (change scores): No. 1: 8.5, 5% change, nt No. 2: −3, −1.8% change, nt No. 3: −5, −2.9% change, nt No. 4: −1, −0.6% change, nt no raw scores reported SRSI: Awareness: No. 1: pre1 10; pre2 10; post1 8; post2 9.5; −4.5% change (pre1-post2), nt No. 2: pre1 10; pre2 10; post1 6.5; post2 6; −36.4% change (pre1-post2), nt No. 3: pre2 8; post1 5.5; post2 7.5; −4.5% change (pre2-post2), nt BRIEF–A: decrease of ∼1 standard deviation, no scores reported, nt EFPT: mean decrease of 3-5 points No. 1: pre1 5; pre2 4; post1 1; post2 2; −12.5% change (pre1-post2), nt No. 2: pre1 12; pre2 10; post1 7; post2 6; −24% change (pre1-post2), nt No. 3: pre2 9; post1 3; post2 4; −20% change (pre2-post2), nt No. 4: pre2 6; post1 2; post2 0; −24% change (pre2-post2), nt MET errors: mean decrease of 5 points</td>
<td>ADL ability (AMPS) improved in all 4 participants.</td>
<td>+EFPT, MET BRIEF–A (PND 100%) SRSI awareness (PND 100%), AQ (−) observed</td>
<td>+EFPT, MET BRIEF–A (PND 100%) SRSI strategy use (PND 100%) observed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(continues)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author/s</td>
<td>country</td>
<td>N (E/C)</td>
<td>Intervention</td>
<td>Design/FU</td>
<td>Awareness outcome (E: score/C: score)</td>
<td>Other Outcome Measures (E: score/C: score)</td>
<td>Effect on awareness (ES)</td>
<td>Effect on other outcomes (ES)</td>
</tr>
<tr>
<td>----------</td>
<td>---------</td>
<td>---------</td>
<td>--------------</td>
<td>-----------</td>
<td>---------------------------------------</td>
<td>------------------------------------------</td>
<td>-------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Toglia et al</td>
<td>USA</td>
<td>1/0</td>
<td>Multicontext approach</td>
<td>Single subject design with repeated pre-post measures (4 wk before and after)</td>
<td>SRSI awareness pre1 10; post 1 8; post 2 9.5; −4.5% change (pre2-post2), nt</td>
<td>SRSI strategy pre1 10; post 1 8; post 2 9.5; −4.5% change (pre2-post2), nt</td>
<td>+ EFPT (PND 100%), MET (PND 100%), BRIEF informant (PND 0%)</td>
<td>0 SRSI awareness (PND 100%), AQ (PND 0%) observed</td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>Author/s country</th>
<th>N (E/C)</th>
<th>Intervention</th>
<th>Design/FU</th>
<th>Awareness outcome (E: score/C: score)</th>
<th>Other Outcome Measures (E: score/C: score)</th>
<th>Effect on awarenessb (ES)</th>
<th>Effect on other outcomes (ES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhou et al43 USA</td>
<td>3/0</td>
<td>Neurobehavioral rehabilitation program and game format training</td>
<td>SCED/ 2 and 4 wk FU</td>
<td>CRS difference score No. 1: base 32; phase 1 34; phase 2 21; phase 3 21; −3.9% change (baseline-phase 3), nt No. 2: base 44; phase 1 25; phase 2 31; −4.6% change (baseline-phase 2), nt No. 3: base 17; phase 1 19; phase 2 26; phase 3 27,3.5% change (baseline-phase 3), nt Knowledge of ABI residuals % correct responses: No. 1: behavior: base 60%; treatment 33%; FU 50%, nt cognition: base 16.5%; treatment 54.8%; FU 91.5%, nt</td>
<td>BRIEF informant rating pre 1 61; pre 2 63; post 1 52; post 2 56, nt MET: pre 1 2; pre 2 3; post 1 10; post 2 6; 30.8% change, nt EFPT: pre 1 12; pre 2 10; post 1 0; post 2 6; −23.1% change, nt</td>
<td>0 SRSI strategy (PND 100%) FU: trend toward return to baseline observed</td>
<td>0 CRS difference score (PND 50%) + % correct responses (PND 81% behavior; 80% cognition; 36% physical) observed</td>
</tr>
</tbody>
</table>

(continues)
<table>
<thead>
<tr>
<th>Author/s country</th>
<th>N (E/C)</th>
<th>Intervention</th>
<th>Design/FU</th>
<th>Awareness outcome (E: score/C: score)</th>
<th>Other Outcome Measures (E: score/C: score)</th>
<th>Effect on awareness&lt;sup&gt;b&lt;/sup&gt; (ES)</th>
<th>Effect on other outcomes (ES)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Physical: base 16.4%; treatment 62.4%; FU 49.5%, nt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No. 2: behavior: base 22%; treatment 84.2%; FU 84.5%, nt cognition: base 67.3%; treatment 96.3%; FU 91.5%, nt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>physical: base 60.8%; treatment 83.4%; FU 83%, nt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No. 3: behavior: base 38.6%; treatment 84.3%; FU 91.5%, nt cognition: base 48.1%; treatment 92.3%; FU 75%, nt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>physical: base 47.8%; treatment 95.9%; FU 91.5%, nt</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: C, control group; E, experimental group; ES, effect size; FU, follow-up; na, not applicable; ns, not significant; nt, not tested; PND, percentage of nonoverlapping data; RCT, randomized controlled trial; SCED, single-case experimental design.

<sup>a</sup>See Document, Supplemental Digital Content 2, available at http://links.lww.com/JHTR/A88, for an explanation of abbreviations and interpretation of outcome measures.

<sup>b</sup>Pretest SRSI scores originally were reported as raw scores instead of average scores.

<sup>c</sup>This case study was part of the larger case series study of Toglia et al.44
Other outcome measures focused on sustained attention, executive functioning, neglect, motor and process skills, activities of daily living, level of functional independence, community integration, feelings of competency, and quality of life. The specifics of the functional outcome measures appear in Table 1.

In 3 of the 9 studies, the effect of the intervention on awareness was statistically significant (Hedge’s g = 1.0–1.7; PND 100%). In 2 studies, the effects were not statistically tested, but the authors reported a positive treatment effect on awareness (PND 36%-81%). However, in these studies, the positive treatment effects appeared to be task specific. Statistically significant improvements on other outcome measures were seen in functional independence (Hedge’s g = 0.5), activities of daily living (Hedge’s g = 0.8), and process skills (Hedge’s g = 1.0).

**Moderate-quality studies**

The moderate-quality studies consisted of uncontrolled pre-post studies (N = 10) and single-case designs (N = 6). The mean number of participants was 22, and sample sizes ranged from 1 to 86. Awareness outcome was mostly determined using the SADI (N = 4), the Patient Competency Rating Scale (N = 3), the discrepancy between estimated and actual task performance (N = 3), the AQ (N = 2), the Clinicians Rating Scale for evaluating Impaired Self-Awareness and Denial of Disability after brain injury (N = 2), and the SRSI (N = 2). In 7 of the 16 moderate-quality studies, the effect of the intervention on at least 1 awareness outcome was statistically significant (P < .05). However, here again these observed positive effects were related to task-specific improvement and reflected only in 1 study an increase in awareness of deficits. Positive effects on other outcomes included decreased depressive symptoms and distress, decreased behavioral problems, increased psychosocial well-being and psychosocial functioning, strategy use, self-regulation, and a more cooperative attitude to accept assistance or participate in treatment.

**Patient characteristics**

**High-quality studies**

Detailed patient characteristics of the high-quality studies are described in Table 2. All participants were adults aged 20 to 76 years; the approximate mean age was 45 years, and the majority (median 63%) were men. In 5 of the 9 high-quality studies, patients experienced a TBI and in 1 study, the patients had a stroke. In the remaining studies, the etiology of the brain injury was mixed (eg, TBI, stroke, anoxia) and ranged from moderate to severe on the basis of the Glasgow Coma Scale, posttraumatic amnesia, or duration of coma. In 7 studies, patients were in the chronic phase after injury (>6 months postinjury) at the start of the awareness intervention. In addition, in 7 studies, patients received outpatient treatment. In the 2 studies in which patients were hospitalized, 1 group was in the subacute phase and the other was in the chronic phase after injury.

The high-quality studies differed in patients’ level of baseline functioning prior to treatment. Cheng and Man reported moderate baseline Functional Independence Measure scores (experimental group score = 67; control group score = 75) and Lawton instrumental activities of daily living (IADL) scores (experimental group score 4.4; control group score 4.6). Tham reported the baseline score on the Mini-Mental State Examination (MMSE), which ranged from 22 to 27. (See Document, Supplemental Digital Content 2, available at http://links.lww.com/JHTR/A88, for the specifics of these scales). In the other studies, patients were independent in basic activities of daily living or had basic self-care skills, had a moderate level of disability, had severe to moderate sensory and motor deficits, had a moderate level of disability, or showed serious aggressive behavior. In 2 studies, no baseline level of functioning was reported.

Baseline levels of impaired awareness varied across studies. In 2 studies, therapists recommended patients for awareness treatment based on clinical judgment of evidence of impaired self-awareness. In one study, patients were included if they underestimated their memory deficits (incongruence between predicted memory performance and actual performance). In another study, patients had a SADI score greater than 0 (mean SADI score at baseline was 5). Furthermore, studies reported high SRSI scores (range: 6–10), high SADI scores (8), and a large difference score on the AQ (range: 22–30) at baseline. In 2 studies, baseline levels of awareness were not specified.

**Moderate-quality studies**

In moderate-quality studies, patients had an approximate mean age of 40 years (range: 19–70 years) and the majority (median 68%) were male. Most studies used patients with different types of ABI (eg, TBI, stroke, hypoxia, infection) and ranged from moderate to severe on the basis of the Glasgow Coma Scale, posttraumatic amnesia, or duration of coma. In 2 studies, patients were in the chronic phase after injury (>6 months postinjury) at the start of the awareness intervention. In addition, in 7 studies, patients received outpatient treatment. In the 2 studies in which patients were hospitalized, 1 group was in the subacute phase and the other was in the chronic phase after injury.
### TABLE 2  Patient characteristics

<table>
<thead>
<tr>
<th>Author/s</th>
<th>Mean age and male N(%)</th>
<th>In- or outpatient</th>
<th>Inclusion/Exclusion criteria</th>
<th>Etiology/ Diagnostic criteria</th>
<th>Time after onset</th>
<th>Severity ABI</th>
<th>Baseline function and awareness (at start of treatment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chandrashekar and Benshoff⁶⁵</td>
<td>E: 59% 20-40 y 41% 40-60 y (65%)  C: 47% 20-40 y 53% 40-60 y (63%)</td>
<td>Outpatient</td>
<td>Incl: patients with TBI in Southern Illinois and Missouri area</td>
<td>TBI</td>
<td>Chronic phase E: 47% 1-4 y 53% 5 y or more C: 21% 1-4 y 79% 5 y or more</td>
<td>Not specified</td>
<td>Not specified</td>
</tr>
<tr>
<td>Cheng and Man⁶⁵</td>
<td>E: 54.9 (64%)  C: 58.1 (60%)</td>
<td>Inpatient</td>
<td>Incl: Appropriate communication abilities, stable and alert (GCS = 15/15). SADI score of &gt;0</td>
<td>TBI</td>
<td>Rehabilitation phase: mean hospital phase 5.2 wk (E + C). Average rehabilitation stay E: 7.5; C: 10 wk</td>
<td>GCS E: 10  C: 12.6</td>
<td>FIM: E: 67; C: 75  Lawton IADL: E: 4.4; C: 4.6  SADI: E: 5.5; C: 5.1</td>
</tr>
<tr>
<td>Goverover et al³⁸</td>
<td>E: 39.5 (20%)  C: 39.2 (20%)</td>
<td>Outpatient</td>
<td>Incl: Some evidence of self-awareness impairment identified by treating therapist Excl: Aphasia and/or severe visual problems or primary psychiatric or substance abuse diagnosis</td>
<td>ABI</td>
<td>E: 12.9 mo  C: 8.6 mo</td>
<td>GCS E: 4.6/15  C: 3.6/15</td>
<td>Independent in basic ADL AAD: E: 14.6; C: 16.5  SRSI: E: 44.2; C: 44.1  AQ-Discrepancy: E: 11.6; C: 13.3</td>
</tr>
<tr>
<td>Rebmann and Hannon⁴⁰</td>
<td>No. 1: 20, male No. 2: 21, male No. 3: 25, male</td>
<td>Outpatient</td>
<td>Incl: Underestimation memory deficit as defined by the inability to accurately predict performance on the memory tasks used. No. 1: AVM rupture No. 2: TBI No. 3: TBI</td>
<td>No. 1: 15 mo  No. 2: 26 mo  No. 3: 36 mo</td>
<td>Coma No. 1: none No. 2: 12 wk No. 3: 7 wk</td>
<td>Enrolled in a special class for adults with brain injury at a community college. Awareness: see inclusion</td>
<td>(continues)</td>
</tr>
<tr>
<td>Author/s</td>
<td>Mean age and male N(%)</td>
<td>In- or outpatient</td>
<td>Inclusion/Exclusion criteria</td>
<td>Etiology/ Diagnostic criteria</td>
<td>Time after onset</td>
<td>Severity ABI</td>
<td>Baseline function and awareness (at start of treatment)</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------</td>
<td>-------------------</td>
<td>-----------------------------</td>
<td>-------------------------------</td>
<td>-----------------</td>
<td>--------------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>Tham et al41</td>
<td>No. 1: 64, female</td>
<td>Outpatient</td>
<td>Incl: Right CVA of no more than 10 wk ago, severe unilateral neglect and physical, psychological, and intellectual capacities that allowed active participation in assessment and training</td>
<td>Right hemisphere stroke</td>
<td>&lt;10 wk</td>
<td>Not specified</td>
<td>MMSE No. 1: 22 No. 2: 26 No. 3: 24 No. 4: 27 Severe sensory loss. Moderate to severe hemiparesis, visual field deficits. Awareness level unknown</td>
</tr>
<tr>
<td></td>
<td>No. 2: 73, female</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No. 3: 76, female</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No. 4: 58, female</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toglia et al44</td>
<td>No. 1: 29, female</td>
<td>Outpatient</td>
<td>Incl: &gt; 6 mo after injury; independence in basic level skills (FIM); minimum assist in communication; ability to attend to task for at least 30 min; competence to provide informed consent; difficulty in managing multistep instrumental ADL</td>
<td>TBI</td>
<td>No. 1: 67 mo</td>
<td>Not specified</td>
<td>Moderate level of disability (Disability Rating Scale). Basic self-care skills (FIM) AQ-Discrepancy: unknown SRSI: No. 1: 10; No. 2: 10; No. 3: 8; No. 4: 6</td>
</tr>
<tr>
<td></td>
<td>No. 2: 27, male</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No. 3: 47, male</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No. 4: 50, female</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toglia et al42</td>
<td>No. 1: 29, female</td>
<td>Outpatient</td>
<td>Incl: &gt;6 mo post-TBI, independence in self-care activities, difficulty in managing multistep instrumental ADL; competence to provide informed consent</td>
<td>TBI</td>
<td>66 mo</td>
<td>Not specified</td>
<td>Moderate level of disability (disability rating scale), living in apartment with 24-h aid and specialized day program. Denial of functional or cognitive difficulties, except for walking and speaking clearly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Patient characteristics (Continued)

<table>
<thead>
<tr>
<th>Author/s</th>
<th>Mean age and male N(%)</th>
<th>Severity ABI</th>
<th>Time after onset</th>
<th>In- or outpatient</th>
<th>Inclusion/Exclusion criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhou et al43</td>
<td>No. 1: 30, male</td>
<td>Not specified</td>
<td>1: 24 mo</td>
<td>Inpatient</td>
<td>Residents of the rehabilitation program and recommended for awareness instruction by clinical treatment team</td>
</tr>
<tr>
<td></td>
<td>No. 2: 32, male</td>
<td></td>
<td>No. 2: 18 mo</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No. 3: 31, male</td>
<td></td>
<td>No. 3: 120 mo</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Etiology/ Diagnostic criteria

<table>
<thead>
<tr>
<th>Etiology/Diagnostic criteria</th>
<th>Time after onset</th>
<th>In- or outpatient</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1: anoxic</td>
<td>1: 24 mo</td>
<td>Inpatient</td>
</tr>
<tr>
<td>No. 2 and No. 3: TBI</td>
<td>2: 18 mo</td>
<td></td>
</tr>
<tr>
<td>No. 3: PTA, posttraumatic amnesia, TBI</td>
<td>3: 120 mo</td>
<td></td>
</tr>
</tbody>
</table>

### Baseline function and awareness (at start of treatment)

- Physical and verbal aggressive behavior. No. CRS difference: No. 1: 32; No. 2: 44; No. 3: 17; Knowledge residuals % correct responses: see Table 1.

### Table 2

<table>
<thead>
<tr>
<th>Author/s</th>
<th>Mean age and male N(%)</th>
<th>Severity ABI</th>
<th>Time after onset</th>
<th>In- or outpatient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhou et al43</td>
<td>No. 1: 30, male</td>
<td>Not specified</td>
<td>1: 24 mo</td>
<td>Inpatient</td>
</tr>
<tr>
<td></td>
<td>No. 2: 32, male</td>
<td></td>
<td>2: 18 mo</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No. 3: 31, male</td>
<td></td>
<td>3: 120 mo</td>
<td></td>
</tr>
</tbody>
</table>

### Abbreviations

- ABI, acquired brain injury
- AVM, arteriovenous malformation
- C, control group
- E, experimental group
- GCS, Glasgow Coma Scale
- PTA, posttraumatic amnesia
- TBI, traumatic brain injury

Intervention characteristics

#### High-quality studies

The detailed characteristics of the interventions from high-quality studies are described in Table 3. All interventions consisted of more than 1 component. The majority used some form of psychoeducation about deficits, often in combination with feedback on performance. Education was given by presenting declarative knowledge about deficits, experiential functional exercises guided by therapists or by using a board game with a question-answer-reward format. Feedback was given verbally, visually, or audiovisually, by positive reinforcement, or by nonconfrontational discussion between patient and researcher about task performance or by self-evaluation.

Occupational therapy was the major discipline involved in the studied interventions. In 1 study, a psychologist was involved. In 3 studies, the discipline was not stated.

Treatment duration and intensity varied across the 9 studies, ranging from 3 to 12 weeks and the total number of sessions ranging from 6 to 40 (45 minutes-2 hours).

The treatment programs were effective in improving awareness in 5 of the 9 high-quality studies. Therefore, they are described more thoroughly.

Goverover et al138 investigated an occupation-based training protocol. Twenty patients with some evidence of self-awareness performed IADL tasks. The patients in the experimental group had to predict their performance before a task, then estimate and evaluate their performance afterward. They were stimulated to think of a strategy to improve their task performance. Participants had learned to improve IADL activities and showed better self-regulation. The improvement in self-regulation was significant (Hedge’s $g = 1.0$). Self-regulation was defined as having awareness, the readiness to change and formulating strategy behaviors. The patients in the control group completed the IADL tasks without the awareness intervention. On specific awareness measures, no significant treatment effect was observed.

Tham et al41 investigated awareness in 4 women with mild to moderate cognitive disabilities and severe sensory loss. Patients were fewer than 10 weeks poststroke and had intellectual awareness at baseline. The 4-week intervention phase consisted of training purposeful and...
TABLE 3  Intervention characteristics

<table>
<thead>
<tr>
<th>Author/s</th>
<th>Aim of intervention</th>
<th>Intervention (E/C)</th>
<th>Disciplines involved</th>
<th>Duration/Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chandrashekar and Benshoff⁵⁵</td>
<td>To determine if persons with TBI who participate in 6 weeks of the Quality of Life and Awareness Training differ significantly from those who do not participate in the way that (1) they perceive quality of life and (2) they are aware of their deficits.</td>
<td>E: 6 wk Quality of Life and Awareness Training (QLAT). Training goals and activities were established on the basis of the Wisconsin HSS Quality-of-Life Inventory. Awareness training goals and activities were based on Ownsworth et al’s⁹¹ workbook on group activities for persons with TBI. C: no QLAT, playing board games and cards in a group.</td>
<td>Not specified</td>
<td>E: 6 sessions in 6 wk. Each session was 1 h and 30 min in length with 10-min break. C: 6 sessions of 1 ½ h during 6 wk</td>
</tr>
<tr>
<td>Cheng and Man²⁵</td>
<td>Management of impaired self-awareness</td>
<td>E: Awareness Intervention Program: education to enhance objective knowledge about deficits; experiential, functional exercises to enhance patients’ awareness of changes in their ability; practice of self-performed prediction and goal-setting during experiential functional exercise; concrete and extensive feedback. Individual. C: Conventional rehabilitation program: included physical, functional, and cognitive aspects of occupational therapy. In groups, participants were trained in activities of daily living, training in motor function prerequisites for functional tasks, cognitive training (unstructured orientation and memory group), and a predischarge arrangement group.</td>
<td>Not specified</td>
<td>4 wk, 5 d a week, 2 sessions per day.</td>
</tr>
</tbody>
</table>

(continues)
<table>
<thead>
<tr>
<th>Author/s</th>
<th>Aim of intervention</th>
<th>Intervention (E/C)</th>
<th>Disciplines involved</th>
<th>Duration/Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goverover et al(^{38})</td>
<td>Alleviate difficulties related to self-awareness and self-regulation and to address functional performance outcomes</td>
<td>Performance of one instrumental activity of daily living. E: Prior to task, participant defined task goals; predicted performance; anticipated and preplanned for errors or obstacles; chose a strategy to avoid errors; assessed amount of assistance needed. After task completion, participant estimated and evaluated own performance, followed by a discussion with the researcher. Afterwards the participant wrote experiences in a journal. C: conventional practice, including direct corrective feedback from therapist.</td>
<td>Occupational therapy</td>
<td>6 individual sessions (45 min) over 3 wk</td>
</tr>
<tr>
<td>Ownsworth et al(^{39})</td>
<td>To target error awareness and self-correction in 2 real-life settings: (1) cooking at home and (2) volunteer work</td>
<td>Prior to baseline assessment subject practices cooking a meal with his mother’s support. Treatment: Feedback about the subject’s postinjury changes. Education for family, feedback prompting during the specific performances on cooking and work tasks. Prompting according to the principles of “Pause, Prompt and Praise.”(^{62}) Role reversal technique (observing mother cook en give her feedback). External reminder (electronic timer) for checking recipe, precutting discussion, and postcooking feedback discussion. Video feedback. Similar techniques were used in the volunteer task.</td>
<td>Occupational therapist</td>
<td>Cooking: 16 wk: 4 wk baseline, 8 wk treatment, and 4 wk maintenance and generalization Work: 16 wk: 12 wk baseline, 4 wk treatment.</td>
</tr>
<tr>
<td>Rebmann and Hannon(^{40})</td>
<td>To test an intervention for reducing unawareness of memory deficits using a behavioral approach</td>
<td>Baseline condition: no feedback during performance treatment: (1) visual and verbal feedback: problem solving approach, encouraging subjects to find out why their predictions did not match their performance and (2) positive reinforcement: verbal praise and lottery tickets.</td>
<td>Not specified</td>
<td>No. 1: 8 treatment sessions No. 2: 6 treatment sessions No. 3: 6 treatment sessions Duration and intensity: 2 sessions a week for 5-6 wk.</td>
</tr>
<tr>
<td>Author/s</td>
<td>Aim of intervention</td>
<td>Intervention (E/C)</td>
<td>Disciplines involved</td>
<td>Duration/intensity</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>---------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Tham et al⁴¹</td>
<td>Improving awareness of disabilities in client with unilateral neglect</td>
<td>A phase: occupational therapy; 5 days a week focused on training in self-care activities by using the participants available abilities and by adapting tasks demands and contexts. Patients participated in other rehabilitation services as well. B phase: Focus of occupational therapy on training awareness of abilities. Therapists support the patients to choose motivating training tasks; discuss and evaluate performance (including learning compensatory techniques); use the home environment (eg, confrontation); video feedback; using therapeutic narratives</td>
<td>Occupational therapy</td>
<td>ABA: A1 phase: baseline observations during 4 sessions over 2-wk period. 1-2 h a day. Intervention phase B: 4 data collection sessions over 4 wk, 1 h to 2 h a day, 5 days a week. A2 FU phase: 2 times data collection after 5 and 9 wk</td>
</tr>
<tr>
<td>Toglia et al⁴²</td>
<td>To improve proximal outcomes (cognitive strategies and self-regulation), distal outcomes (general awareness and everyday function), and maintenance of gains 4 wk FU</td>
<td>Guided anticipation of challenges, guided strategy generation, error discovery phase, strategy training/mediation phase, reinforcement of strategy use, session self-evaluation, structured journal</td>
<td>Occupational therapy</td>
<td>75-min sessions, twice per week over ~5 wk</td>
</tr>
<tr>
<td>Toglia et al⁴²</td>
<td>To improve learning and transfer of strategy use, self-monitoring skills, performance in functional tasks postintervention, and awareness</td>
<td>See Toglia et al⁴⁴</td>
<td>Occupational therapy</td>
<td>75-min sessions, twice per week over ~5 wks</td>
</tr>
<tr>
<td>Author/s</td>
<td>Aim of intervention</td>
<td>Intervention (E/C)</td>
<td>Disciplines involved</td>
<td>Duration/Intensity</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Zhou et al43</td>
<td>A game format to teach information about ABI to persons experiencing the effects of such injuries.</td>
<td>Six categories were targeted: behavior, emotion, cognition, communication, physical, and sensory. Each category consists of 18 questions concerning terminology, effect of residuals on a person’s life and potential compensatory strategies. Question written on one side of the card, answer on the other side. Scores on a modified Trivial Pursuit board. Per game 3 x 6 = 18 questions + percentage of correct response. 3 phases (1: behavior and emotion, 2: cognition and communication, 3: physical and sensory). When 70% correct, then go to next phase. Monetary award for participation, success, and winning.</td>
<td>Psychology; advanced graduate students, master’s degree in behavior analysis and therapy.</td>
<td>1 h 3 times a week. Duration 31 sessions (5 baseline sessions, 26 treatment sessions, 2 FU sessions). FU sessions 2-4 wk after final game.</td>
</tr>
</tbody>
</table>
meaningful daily tasks at both the rehabilitation center and the home environment. Strategy behaviors were encouraged, followed by self-evaluation and visual and verbal feedback. Awareness of abilities improved in these 4 patients (clinically meaningful change). The PND of 100% indicates that the treatment was highly effective. The improvements were maintained at follow-up in 2 of 3 patients.

Cheng and Man²⁵ conducted an RCT with 22 patients with moderate ABI in the postacute phase with intellectual awareness as baseline. The experimental group received a 4-week Awareness Intervention Program that included enhancing objective knowledge about deficits, experiential functional exercises, practice of self-performed prediction and goal setting, and concrete and extensive feedback. The control group followed a conventional rehabilitation group program including training in activities of daily living, training in motor function, and cognitive training. The result was an improvement in the level of awareness and in functional activities of daily living and IADL activities for the experimental group, but not the control group (Hedge’s g = 0.5-1.7).

The behavioral approach of Rebmann and Hannon⁴⁰ was based on positive verbal (praise) and materialistic (lottery tickets) reinforcement for more accurate predictions of performance. Task-specific awareness improved in all 3 participants; however, the effect of the treatment was questionable as indicated by a PND of 56%.

Zhou⁴³ investigated a modified Trivial Pursuit game format intervention over a period of 11 weeks using positive feedback in 3 aggressive men with severe TBI who had poor awareness of deficits in the chronic phase recovery. Participants engaged in 1-hour group sessions 3 times a week (32 sessions). The topics included “behavior and emotion,” “cognition and communication,” and “physical and sensory.” For each topic, the questions concerned terminology, the effects that limitations might have on a person’s life, and potential compensatory strategies. Feedback was positive when answers were correct and informative (ie, corrective) when answers were incorrect. All 3 patients showed improvement in general knowledge of the consequences of ABI (PND 80%–81%). However, a general understanding of the impact of ABI may not reflect patients’ awareness of their own deficits. There was no change observed in the discrepancy between ratings given by patients and clinicians on a competency rating scale, indicating that patients’ knowledge of their own deficits did not improve (PND 50%).

The remaining 4 studies in the high-quality group did not show improvement in awareness of deficits. However, the 2 studies of Toglia et al⁴²,⁴⁴ are worth describing briefly because of the theoretical background of the intervention.

Toglia et al⁴²,⁴⁴ outlined the importance of generalizing strategy use from trained to untrained tasks. Therefore, they used a multicontext approach that included systematically varying treatment activities and context and gradually increasing transfer distance. In 9 sessions, improvements were observed in monitoring skills and strategy use (PND 100%), and these improvements persisted in 3 of 4 patients at follow-up in one study,⁴⁴ but not in the other.⁴² General awareness of deficits, however, remained unchanged. Toglia et al⁴¹ and Ownsworth et al⁶⁴ suggested that persons who lack understanding of their general deficits still are able to learn to use and monitor a strategy across situations. The underlying mechanisms may include automatic learning and habit formation and active and deliberate self-monitoring mechanisms.

**Moderate-quality studies**

The types of interventions in the moderate-quality studies are similar to those of the high-quality studies. They were diverse as well and consisted of multiple components, such as the therapeutic relationship (N = 3),⁵⁵,⁵⁷,⁵⁸ education and feedback (N = 9),⁶,⁴⁶,⁴⁷,⁵¹,⁵⁴,⁵⁶–⁵⁸,⁶⁰ coping and problem-solving (N = 2),⁴⁷,⁵³ and social skills training (N = 1).⁵⁰ The interventions of the moderate-quality studies were mostly carried out by a multidisciplinary team (N = 5),⁶,⁴⁷,⁴⁸,⁵²,⁶⁰ Other disciplines involved were psychology (N = 3),⁴⁶,⁵⁰,⁵³ occupational therapy (N = 3),⁵⁷–⁵⁹ and neurology (N = 1).⁵¹ In 4 studies, the type of therapy was not clearly specified.⁴⁹,⁵⁴–⁵⁶ The intensity of the interventions varied between studies from 1 session to 56 sessions, with an average duration of 14 weeks and an average of 4 days a week therapy. Three interventions used group therapy.⁶,⁴⁷,⁵⁰ The other interventions consisted of individual training.

**Quality assessment**

Although the CONSORT Statement is primarily intended to address RCTs, an effort was made by the authors to review non-RCT studies of higher quality as well as the validity and applicability of their results.

The quality of the 9 high-quality studies is presented in Table 4. In general, the quality of the report was moderate. No study scored more than 50% on the checklist. Positive aspects were accurate reporting in the abstract, introduction, and discussion. The method sections, however, were of lower quality. The description of intervention methods was mostly in global terms, without specific discussion of the similarities and differences between interventions. Furthermore, descriptions of the procedure for tailoring interventions to individual participants and details of how therapist
adherence to the protocol was assessed or enhanced were often not indicated.

DISCUSSION

This systematic literature search of the available treatment methods for unawareness of deficits in people with brain injury yielded 25 studies for inclusion. Nine studies with controlled or single case experimental designs were considered to be high quality and were investigated thoroughly. Interventions were performed mostly in people with traumatic brain damage who were in the chronic phase and had moderate to severe levels of injury.

Conceptual and methodological differences made it difficult to compare studies. As noted in previous reviews, researchers used different interventions to address impaired self-awareness. The majority of the treatments included a combination of psychoeducation and feedback.

Three interventions (2 RCTs and 1 SCED) showed promising results with multimodal training and feedback. These studies utilized patients in the postacute phase of rehabilitation with intellectual awareness at baseline. It remains unclear which aspects of the treatment were effective, but the interventions in these studies shared some elements that might have led to improvements in awareness. These were training functional skills in real life settings, guided experience, multimodal feedback, and dialogue between therapist and patient, which could best be described as Socratic reasoning. The last of these comports with the view that motivational interviewing might be a useful technique to improve awareness of deficits.

Furthermore, 2 studies investigated awareness interventions in an artificial training situation. In patients with ABI exhibiting severe lack of awareness, a single task or game was practiced, and performance was rewarded on the basis of the principles of operant conditioning. These interventions led to task-specific improvements in awareness.

The studies that did show a positive effect of intervention on awareness included patients with at least some intellectual awareness. To date, there is no convincing evidence that people with unawareness in the chronic phase post-ABI may progress to some level of intellectual awareness. It remains unclear whether awareness of deficits can be improved in patients with very poor intellectual awareness who are in the chronic phase after injury when spontaneous recovery is unlikely. Moreover, a prerequisite for intellectual awareness is the basic cognitive ability of patients to remember and integrate past experiences to draw conclusions about the commonalities between their pre- and postinjury experiences. Thus, significant deficits in abstract reasoning or memory during...
the chronic phase of recovery might underlie enduring limitations in intellectual awareness.\textsuperscript{15}

There are still many questions to be answered. To formulate general guidelines for the development of an awareness intervention, several points need further attention. First, many studies lack a theoretical perspective. Although some studies acknowledge and hypothesize 2 or 3 components underlying the concept of awareness, they do not specifically report at which component of awareness their intervention and outcome measures are aimed. Defining these factors is necessary to frame the results in a theoretical perspective to verify and refine the existing theories. Second, there are several good quality measurement instruments to assess awareness.\textsuperscript{66} However, these measurements do not encompass all 3 components of awareness. This is important to consider when evaluating the impact of awareness interventions. Third, the concepts “learning” and “changing awareness” seem to be used interchangeably. It remains unclear whether a task-specific improvement is the result of increased awareness or simply learning a task. Only when an improvement can be generalized to other nontrained tasks or daily functioning, one can speak of an improvement in awareness.

Before reaching a consensus on how to treat unawareness of deficits, we should agree on an underlying theory and standardize measures of awareness to promote accurate determination of treatment effects. The next step is to take into account patients’ basic and higher-order cognitive deficits that may affect awareness and, thus, determine the patients’ current ability to be aware of their problems.\textsuperscript{15} Another conceptual issue to address is the fact that the reviewed studies did not distinguish between impaired self-awareness and denial of disability, that is, the psychological component of awareness. These concepts are not mutually exclusive, but likely require different treatment approaches.\textsuperscript{58,67}

In general, the quality of the study reports was moderate. Often, the description of the intervention was not clearly stated or was explained only in general terms. It was never reported how therapist adherence to the treatment protocol was assessed or enhanced. In addition, it was not always clear what the important outcome measures were and how they were used in the analysis. These results are in line with those of a previously published systematic review concerning the content of evidence-based cognitive rehabilitation, which emphasized the lack of information provided in studies about the actual content of treatment.\textsuperscript{68}

This review differs from previous reviews in that it used less stringent restrictions on included studies of methods to improve awareness of deficits, resulting in a broad spectrum of research. However, this approach has its limitations. The heterogeneity of the studied samples in terms of injury severity, brain injury etiology, time since injury, and the small sample sizes of several studies limit the generalizability of the results and the practical applicability of the conclusions. Also, we utilized authors’ conclusions in interpreting the effects of studies that lack statistical test results, and these conclusions may be too optimistic or even erroneous. However, for some studies, the calculated PNDs, despite its limitations, provided a better basis for interpretation of the results.

Unawareness of deficits in patients with ABI is a well-known clinical problem that hinders the rehabilitation process. To tackle this problem, a practical and evidence-based protocol to improve awareness is necessary; however, such a protocol is not yet available. We advise clinicians to consider the improvement of awareness as a primary treatment goal and not as merely a byproduct of rehabilitation. In other words, if a patient undergoes cognitive rehabilitation but is unaware of his or her cognitive deficits, one main objective of cognitive rehabilitation should be to increase awareness of the patient’s problems. Furthermore, future studies should consider the use of the CONSORT Statement\textsuperscript{36,37} to improve methodological quality reporting.

On the basis of this review, we can propose some tentative guidelines regarding treatment of patients with impaired self-awareness. A general approach to improve awareness includes training functional skills in multiple, preferably real life, settings with feedback using guided experience in a Socratic dialogue. Furthermore, to choose which intervention is most appropriate for a specific patient, it is helpful to determine a cognitive profile of strengths and weaknesses, because cognition is an important component of awareness of deficits.\textsuperscript{13} It is also worthwhile to determine on which learning level the intervention should focus. For example, if the intervention is aimed at improving a specific task, the training could be based on procedural and explicit learning. If the goal is improving ability, the intervention is more complex. In this case, generalization across tasks is necessary, and it requires the meta-cognitive ability to reflect upon oneself, which is an important aspect of awareness.

Although we realize that the aforementioned considerations will be challenging in both research and clinical settings, they represent a necessary step to move forward to increase understanding and improve the efficacy of interventions aimed at awareness of deficits.

CONCLUSION

Our systematic review showed that impaired awareness after ABI could be improved in patients with some degree of intellectual awareness through a combination of education and multimodal feedback related to performance. However, there still is a need
for high-quality intervention studies with controlled designs (ie, SCED, RCT) based on a theoretic perspective with a detailed description of the content of the intervention and suitable outcome measures. Future research should focus on identifying the components that contribute to improved awareness in people with ABI, preferably using a sound methodology and theoretical perspective. Instead of considering improved awareness as the residual byproduct of rehabilitation, clinicians should specifically focus on awareness and test their efforts to improve awareness with single-case experimental designs.

REFERENCES


www.headtraumarehab.com


