

# Quality of Guidelines for Cognitive Rehabilitation Following Traumatic Brain Injury

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**Introduction:** Cognitive rehabilitation following traumatic brain injury can aid in optimizing function, independence, and quality of life by addressing impairments in attention, executive function, cognitive communication, and memory. This study aimed to identify and evaluate the methodological quality of clinical practice guidelines for cognitive rehabilitation following traumatic brain injury. **Methods:** Systematic searching of databases and Web sites was undertaken between January and March 2012 to identify freely available, English language clinical practice guidelines from 2002 onward. Eligible guidelines were evaluated using the validated Appraisal of Guidelines for Research and Evaluation II instrument. **Results:** The 11 guidelines that met inclusion criteria were independently rated by 4 raters. Results of quality appraisal indicated that guidelines generally employed systematic search and appraisal methods and produced unambiguous, clearly identifiable recommendations. Conversely, only 1 guideline incorporated implementation and audit information, and there was poor reporting of processes for formulating, reviewing, and ensuring currency of recommendations and incorporating patient preferences. Intraclass correlation coefficients for agreement between raters showed high agreement (intraclass correlation coefficient > 0.80) for all guidelines except for 1 (moderate agreement; intraclass correlation coefficient = 0.76). **Conclusion:** Future guidelines should address identified limitations by providing implementation information and audit criteria, along with better reporting of guideline development processes and stakeholder engagement. **Key words:** clinical practice guidelines, cognitive rehabilitation, traumatic brain injury

EACH YEAR, more than 10 million people worldwide, or 100 to 300 per 100 000 population, sustain a traumatic brain injury (TBI).<sup>1,2</sup> Moderate to severe TBI can result in a range of ongoing physical and psychological impairments. Individuals with TBI often have difficulties with memory; attention and concentration; planning, organizing, and decision making; and cognitive as-

pects of communication. These deficits, along with behavior and personality changes, have a greater impact on post-TBI quality of life than do physical disabilities.<sup>3</sup> Inability to return to preinjury employment,<sup>4</sup> poor everyday functioning,<sup>5,6</sup> relationship difficulties, and loss of independence<sup>3,4,6,7</sup> are estimated to contribute to more than 80% of the lifetime cost of TBI to society because of their impact on burden of disease, lost productivity, and long-term care needs.<sup>8,9</sup> Cognitive rehabilitation—defined herein as interventions addressing deficits in attention, executive function, cognitive communication,

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and/or memory—is, therefore, a major focus of overall TBI rehabilitation.<sup>10</sup>

Clinical practice is optimized when informed by the best available evidence.<sup>11,12</sup> Clinical practice guidelines (CPGs) are defined as “systematically developed statements to assist practitioners’ and patients’ decisions about appropriate healthcare for specific clinical circumstances.”<sup>13(p38)</sup> A key benefit of CPGs is that they identify the nature, volume, and quality of research evidence supporting clinical recommendations and connect this information with clinicians at the point of care.<sup>14</sup> CPGs can improve decision making and, ultimately, clinical outcomes, as demonstrated by a study that found an association between CPG implementation and outcomes for adults with TBI.<sup>15</sup> CPGs can also improve consistency of care, inform patients and other stakeholders regarding the treatment they should be receiving, and influence health policy to enhance treatment efficiency and access to services.<sup>14</sup>

It is logical then that the value of CPGs in improving patient outcomes is proportional to the quality of the CPGs. Flawed CPGs may result in the promotion of ineffective, wasteful, or even harmful practices that adversely impact patient and healthcare system outcomes.<sup>14</sup> Evaluating the methodological quality of CPGs can aid in interpretation of their recommendations and identify areas that can be addressed in future guideline development efforts. The aim of the present study was to identify and evaluate the methodological quality of published CPGs for cognitive rehabilitation following TBI as preparation for a wider project that aimed to develop new best practice recommendations in this field.<sup>16</sup>

## METHODS

### Guideline search and selection

Five electronic health databases (MEDLINE, EMBASE, PsycINFO, Cochrane Library, and CINAHL) and 26 Web-based guideline portals were searched to identify published guidelines for the management of rehabilitation following TBI. All searches were conducted in early 2012. Appendix 1 lists all databases and Web sites searched. Appendix 2 contains an example of the search strategy used for health databases (MEDLINE). Titles, abstracts, and full-text publications were evaluated for inclusion using the following criteria:

- *Patient group*: Adults with moderate to severe TBI, defined as an injury to the brain from an external force, resulting in transient or permanent neurological dysfunction<sup>3</sup>
- *Study type*: CPG, defined previously and referred to hereafter as ‘guideline’.<sup>13(p38)</sup> The guideline had to include specific practice recommendations and be evidence based, as reflected by the following items

on the Appraisal of Guidelines for Research and Evaluation (AGREE II) instrument<sup>17</sup>:

- “Systematic methods were used to search for evidence”
- “There is an explicit link between the recommendations and the supporting evidence”
- *Scope*: The scope of the guideline was required to specifically focus on or include a section of recommendations for cognitive rehabilitation after TBI, defined as therapies addressing at least one of the following cognitive functions: attention; executive function; cognitive communication; or memory. The team decided that related topics of behavioral disorders, perception and language impairments, and affective disorders would not be included, as the focus of the project was on cognitive rehabilitation. Perceptual and language impairments are less common in TBI and more commonly associated with focal cerebral injury and cerebrovascular disease.
- *Phase of care*: All relevant phases of care including community-based care.
- *Date range*: Guidelines published from 2002 until January 2012 were eligible for inclusion in the review. Where several versions of the same guideline existed, the most recent version of each guideline was assessed, unless an earlier version contained greater detail on the guideline development process, in which case this one was assessed.
- *Language*: English.
- *Accessibility*: Freely available, that is, copies of guidelines published in peer-reviewed journals, or otherwise freely available without cost via public portals.

Two researchers (L.Pa. and A.K.) independently evaluated titles and abstracts from database searches to identify potentially relevant publications for full-text review. One researcher (L.Pa.) reviewed Web sites to identify publications for full-text review. Full-text publications from both databases and Web sites were reviewed first by the researchers involved in initial screening (L.Pa., A.K., V.P.), followed by 2 other researchers not involved in initial screening (P.B. and M.B.), one of whom (M.B.) had clinical expertise in cognitive rehabilitation for adults with TBI, to resolve any disagreements or uncertainties regarding inclusion and determine the final included guidelines.

### Data extraction

Data were extracted from each guideline regarding country of origin, years covered by literature searching, number of recommendations in total, and number of recommendations pertaining to assessment/general principles of cognitive rehabilitation; posttraumatic amnesia (these were included because of the importance of establishing emergence from posttraumatic amnesia

as a precondition of receiving cognitive rehabilitation therapies); attention; executive function; cognitive communication; and memory.

### Quality appraisal

Eligible guidelines were evaluated using the AGREE II instrument.<sup>18</sup> Both the stand-alone guidelines from the Web search and those published in journal articles were evaluated in the same fashion. Designed by an international team of guideline developers and researchers, the AGREE II instrument comprises 23 quality appraisal items in 6 domains: (1) scope and purpose, (2) stakeholder involvement, (3) rigor of development, (4) clarity of presentation, (5) applicability, and (6) editorial independence. A further item rates the overall quality of the guideline, taking into account the appraisal items across the 6 domains. Each item is scored on a scale from 1 (absence of information or concept very poorly reported) to 7 (exceptional quality of reporting, all criteria for item met).<sup>17</sup> The AGREE II has established construct validity<sup>19</sup> and interrater reliability,<sup>20</sup> and AGREE II quality ratings have been shown to be significant predictors of outcome measures associated with guideline adoption.<sup>20</sup>

Each guideline was independently evaluated by 4 raters to reduce potential for bias in accordance with the AGREE II tool protocol. Two raters who had not been involved in any TBI guideline development (P.B., L.Pa.) evaluated all included guidelines. The remaining raters for each guideline were drawn from a pool of 8 people from the research team (V.P., L.Pi., M.S.-K., C.W.H., R. Te., R. Ta., S.M., and M.B.). Some members of the research team had involvement in the guidelines under review; no rater appraised a guideline they had been involved in developing. For each guideline:

- Standardized Domain Scores for each of the 6 domains were calculated on the basis of the AGREE formula: (Obtained score from all raters – Minimum possible score from all raters)/(Maximum possible score from all raters – Minimum possible score from all raters).
- Individual scores for the 23 AGREE items and the summary overall quality score were calculated by totaling the scores given by all raters and dividing this by the maximum possible score for each item.
- Appraiser agreement was assessed using intraclass correlation coefficients (2-way random model).

The AGREE users manual<sup>18</sup> does not set a benchmark of minimum domain scores representing “high” or “poor” quality; users are advised to set their own criteria on the basis of the context of their appraisal project. In this project, scores are reported against a benchmark of 50%, where scores higher than 50% represent higher quality and scores below 50% represent lower quality.

## RESULTS

### Guidelines included

Database searching yielded 1935 citations, of which 42 full-text documents were reviewed and 7 shortlisted for evaluation. The Web site search yielded 28 documents of which 9 were shortlisted for assessment for inclusion. After application of all inclusion and exclusion criteria, 11 guidelines met inclusion criteria.<sup>21–31</sup>

Table 1 presents an overview of included guidelines. Seven guidelines originated in the United States, 2 were from Europe, 1 was from Canada, and 1 was from New Zealand. The dates of the most recent literature searches included in each guideline paper were from 2008 (1 guideline), 2006 (2), 2004 (3), and 2003 (1), and were not stated for 4 of the guidelines that have been published since 2002. The included guidelines presented a total of 627 recommendations, 140 of which were specific to TBI cognitive rehabilitation. Almost 90% of the total recommendations (560/627) and more than 60% of the TBI cognitive rehabilitation recommendations (87/140) were from 3 guidelines, published as stand-alone documents, that covered the broad field of TBI rehabilitation with subsections on cognitive rehabilitation.<sup>22,26,27</sup> The remaining 8 guidelines, all published as peer-reviewed journal articles, were specific to cognitive rehabilitation practice. These comprised guidelines focusing solely on memory,<sup>24,29</sup> executive function<sup>25</sup> or attention,<sup>28</sup> as well as guidelines covering more than 1 area of cognitive rehabilitation.<sup>22,23,30,31</sup>

The highest number of recommendations across all included guidelines were for “assessment/general principles of cognitive rehabilitation,” totaling 46 (33%) of the 140 cognitive rehabilitation recommendations. This was followed by cognitive communication (30 recommendations, 21% of total cognitive rehabilitation recommendations), memory (24/17%), attention (22/16%), posttraumatic amnesia (10/7%), and executive function (8/6%).

### Quality appraisal

Tables 2 and 3 present domain scores and individual item and overall scores, respectively. A key indicator of methodological quality is the AGREE II domain “rigor of development.” The median score for this domain was 46.4%. Three guidelines achieved domain scores higher than 50%; 4 guidelines achieved scores between 43% and 49%; and 4 guidelines obtained scores below 40%. Performance on the item pertaining to use of a systematic search (item 7) was very strong, with most guidelines (9) scoring above 70% of the total possible score. Performance on the item pertaining to clearly describing selection criteria (item 8) was strong, with most guidelines (8) scoring above 60% of the total possible

**TABLE 1** Overview of included guidelines

| Guideline title and citation  | Country/region   | Years searched    | Total no. recommendations/<br>no. of cognitive rehabilitation | Ax/Prin | PTA | Att | Com | Exe | Mem |
|---|------------------|-------------------|---|---------|-----|-----|-----|-----|-----|
| Acquired Brain Injury Knowledge Uptake Strategy (ABIKUS) Evidence-Based Recommendations for Rehabilitation of Moderate to Severe Acquired Brain Injury (ABIKUS Guideline Development Group 2007) <sup>21</sup>  | Canada           | 1999-2006         | 102/34  | 13      | 4   | 3   | 7   | 2   | 5   |
| Evidence-Based Cognitive Rehabilitation: Updated Review of the Literature from 2003 Through 2008 (Cognitive Rehabilitation Task Force, American Congress of Rehabilitation Medicine Brain Injury Interdisciplinary Special Interest Group: ACRM 2011) <sup>22</sup> | United States    | 2003-2008         | 24/18   | 3       | 0   | 2   | 6   | 3   | 4   |
| EFNS guidelines on Cognitive Rehabilitation: Report of an EFNS task force (European Federation of Neurological Societies: EFNS 2005) <sup>23</sup>  | Europe (various) | NS                | 8/8   | 0       | 0   | 2   | 1   | 0   | 5   |
| Evidence-based practice guidelines for instructing individuals with neurogenic memory impairments: What have we learned in the past 20 years? (Academy of Neurologic Communication Disorders and Sciences: ANCDs 2008) <sup>24</sup>                                | United States    | 1986-2006         | 1/1   | n/a     | n/a | n/a | n/a | n/a | 1   |
| Intervention for executive functions after traumatic brain injury: A systematic review, meta-analysis, and clinical recommendations (Academy of Neurologic Communication Disorders and Sciences: ANCDs 2008) <sup>25</sup>  | United States    | Inception to 2004 | 1/1   | n/a     | n/a | n/a | n/a | 1   | n/a |
| Traumatic Brain Injury: Diagnosis, Acute Management and Rehabilitation Guidelines (New Zealand Guidelines Group: NZGG 2006) <sup>26</sup>   | New Zealand      | 1995-2004         | 287/28  | 13      | 3   | 2   | 7   | 0   | 3   |

(continues)

**TABLE 1** Overview of included guidelines (Continued)

| Guideline title and citation   | Country/region          | Years searched    | Total no. recommendations/<br>no. of cognitive rehabilitation | Ax/Prin   | PTA       | Att       | Com       | Exe      | Mem       |
|--|-------------------------|-------------------|---|-----------|-----------|-----------|-----------|----------|-----------|
| Rehabilitation following acquired brain injury: national clinical guidelines (Royal College of Physicians; RCP 2003) <sup>27</sup>   | Europe (United Kingdom) | NS                | 171/25  | 11        | 3         | 1         | 7         | 1        | 2         |
| Practice guidelines for direct attention training (Academy of Neurologic Communication Disorders and Sciences; ANCDS 2003) <sup>28</sup>                                       | United States           | 1999-NS           | 3/3   | n/a       | n/a       | 3         | n/a       | n/a      | n/a       |
| Evidence-based practice for the use of external aids as a memory compensation technique (Academy of Neurologic Communication Disorders and Sciences; ANCDS 2007) <sup>29</sup> | United States           | Inception to 2003 | 1/1   | n/a       | n/a       | n/a       | n/a       | n/a      | 1         |
| Practice guidelines for standardized assessment for persons with traumatic brain injury (Academy of Neurologic Communication Disorders and Sciences; ANCDS 2005) <sup>30</sup> | United States           | NS                | 5/5   | 3         | n/a       | n/a       | 2         | n/a      | n/a       |
| Guidelines for the Pharmacologic Treatment of Neurobehavioral Sequelae of Traumatic Brain Injury (Neurobehavioral Guidelines Working Group; NGWG 2006) <sup>31</sup>           | United States           | 1960-2004         | 24/16   | 3         | 0         | 9         | 0         | 1        | 3         |
| <b>Total recommendations</b>   |                         |                   | <b>627/140</b>  | <b>46</b> | <b>10</b> | <b>22</b> | <b>30</b> | <b>8</b> | <b>24</b> |

Abbreviations: Ax, assessment; Att, attention; Com, cognitive communication; Exe, executive function; Mem, memory; Prin, principles of cognitive rehabilitation; PTA, posttraumatic amnesia; n/a, not applicable; beyond scope of guideline; NS, not stated.

**TABLE 2** Standardized domain scores(%)<sup>a</sup>

| Guideline                         | 1: Scope and purpose | 2: Stakeholder involvement | 3: Rigor of development | 4: Clarity of presentation | 5: Applicability | 6: Editorial independence |
|-----------------------------------|----------------------|----------------------------|-------------------------|----------------------------|------------------|---------------------------|
| ABIKUS 2007 <sup>21</sup>         | 72                   | 57                         | 46                      | 79                         | 2                | 21                        |
| ACRM 2011 <sup>22</sup>           | 49                   | 14                         | 49                      | 71                         | 3                | 27                        |
| EFNS 2005 <sup>b23</sup>          | 46                   | 12                         | 37                      | 60                         | 1                | 13                        |
| ANCDS Memory 2008 <sup>24</sup>   | 68                   | 32                         | 43                      | 38                         | 1                | 17                        |
| ANCDS Exec 2008 <sup>25</sup>     | 68                   | 26                         | 52                      | 61                         | 1                | 17                        |
| NZGG 2006 <sup>26</sup>           | 93                   | 85                         | 71                      | 88                         | 60               | 83                        |
| RCP 2003 <sup>27</sup>            | 81                   | 79                         | 38                      | 79                         | 14               | 69                        |
| ANCDS Att 2003 <sup>28</sup>      | 72                   | 26                         | 47                      | 51                         | 9                | 23                        |
| ANCDS Mem Aids 2007 <sup>29</sup> | 57                   | 26                         | 38                      | 42                         | 5                | 19                        |
| ANCDS Assess 2005 <sup>30</sup>   | 68                   | 36                         | 29                      | 42                         | 3                | 19                        |
| NGWG 2006 <sup>31</sup>           | 50                   | 18                         | 58                      | 63                         | 3                | 23                        |
| <b>Median</b>                     | <b>68.1</b>          | <b>26.4</b>                | <b>46.4</b>             | <b>61.1</b>                | <b>3.1</b>       | <b>20.8</b>               |

<sup>a</sup>See expansion of all abbreviations which are defined in the main body text of Table 1.

<sup>b</sup>This guideline had 5 raters; all others had 4 raters.

score. Conversely, scores were poor for guideline updating (item 14), external review of the guideline by experts (item 13), and clear description of methods for formulating recommendations (item 10), with most guidelines scoring below 40% for each of these items.

### Domains with high scores

Domain scores were highest for the areas of “scope and purpose” (domain 1) and “clarity of presentation” (domain 4), with median scores across the guidelines of 68.1% and 61.1% of the maximum possible for these domains, respectively. The majority (9/11) of the guidelines achieved a domain score of 50% or higher of the maximum possible for “scope and purpose,” with 4 of these achieving domain scores above 70%. This is reflected by generally high median scores for the individual items pertaining to stating the overall objective (item 1), health questions (item 2), and applicable population (item 3) for the guideline. Similarly, 8 of the 11 guidelines achieved a domain score of over 50% for “clarity of presentation,” including 4 with domain scores above 70%. This indicates that recommendations within the guidelines were generally specific and unambiguous (item 15), clearly outlined management options (item 16), and were easily identifiable (item 17).

### Domains with low scores

Domain scores for 3 domains were low, with medians of 3.1% (“applicability”), 20.8% (“editorial independence”), and 26.4% (“stakeholder involvement”). Ten

guidelines had domain scores of 14% or less in the area of ‘applicability,’ including 8 with scores of 5% or less. Only 1 guideline, that of the New Zealand Guidelines Group (NZGG),<sup>26</sup> achieved a score above 50% in this domain. This was the only guideline to achieve a score of more than 50% in any of the 4 items pertaining to applicability. The remaining guidelines had low scores for all 4 of these items—description of facilitators and barriers to application of the guideline (item 18); advice or tools on how to put the guideline into practice (item 19); resource implications of applying the recommendations (item 20); and presentation of monitoring or audit criteria (item 21). Only 2 guidelines achieved domain scores higher than 50% for “editorial independence,” with the remaining scores all less than 30%, largely due to poor recording of competing interests of the guideline development group (item 23). Only 3 guidelines achieved domain scores above 50% for “stakeholder involvement,” with the remaining 8 all scoring below 40%. This was a consequence of poor scores for incorporating the views and preferences of the target population (item 5) and ensuring broad stakeholder representation within the guideline development group (item 4).

### Overall quality

Nine of the 11 guidelines received 50% or more of the total possible score for overall quality, comprising 8 with scores between 50% and 61% and 1, that of the NZGG,<sup>26</sup> with a score of 86%. The high overall rating of the NZGG guideline<sup>26</sup> is reflected in its overall performance as measured by the AGREE tool; this guideline

**TABLE 3** Individual scores for the 23 AGREE items and overall quality scores<sup>a</sup>

| Domain  | Agree item <sup>18</sup>   | % Total possible score for item |                            |                            |                                       |                                     |                            |                           |                                    |  |                                       |                            |        |
|---|--|---------------------------------|----------------------------|----------------------------|---------------------------------------|-------------------------------------|----------------------------|---------------------------|------------------------------------|--|---------------------------------------|----------------------------|--------|
|   |  | ABIKUS<br>2007 <sup>21</sup>    | ACRM<br>2011 <sup>22</sup> | EFNS<br>2005 <sup>23</sup> | ANCDS<br>Memory<br>2008 <sup>24</sup> | ANCDS<br>Exec<br>2008 <sup>25</sup> | NZGG<br>2006 <sup>26</sup> | RCP<br>2003 <sup>27</sup> | ANCDS<br>Att<br>2003 <sup>28</sup> | ANCDS<br>Mem<br>Aids<br>2007 <sup>29</sup> | ANCDS<br>Assess<br>2005 <sup>30</sup> | NGWG<br>2006 <sup>31</sup> | Median |
| 1: Scope and purpose  | 1. The overall objective(s) of the guideline is (are) specifically described.                                | 86                              | 61                         | 63                         | 86                                    | 79                                  | 100                        | 82                        | 79                                 | 75   | 75                                    | 68                         | 79     |
|   | 2. The health question(s) covered by the guideline is (are) specifically described                           | 61                              | 50                         | 46                         | 61                                    | 71                                  | 89                         | 79                        | 82                                 | 50   | 71                                    | 61                         | 61     |
|   | 3. The population (patients, public, etc) to whom the guideline is meant to apply is specifically described. | 82                              | 57                         | 51                         | 71                                    | 68                                  | 93                         | 89                        | 68                                 | 64   | 71                                    | 43                         | 68     |
| 2: Stakeholder involvement  | 4. The guideline development group includes individuals from all relevant professional groups                | 86                              | 39                         | 31                         | 32                                    | 29                                  | 89                         | 86                        | 36                                 | 39   | 32                                    | 43                         | 39     |
|   | 5. The views and preferences of the target population (patients, public, etc) have been sought               | 18                              | 14                         | 17                         | 18                                    | 14                                  | 79                         | 64                        | 14                                 | 18   | 29                                    | 18                         | 18     |
| 3: Rigor of development   | 6. The target users of the guideline are clearly defined   | 86                              | 25                         | 26                         | 75                                    | 68                                  | 93                         | 96                        | 61                                 | 54   | 75                                    | 29                         | 68     |
|   | 7. Systematic methods were used to search for evidence   | 75                              | 71                         | 60                         | 86                                    | 82                                  | 96                         | 54                        | 79                                 | 82   | 71                                    | 93                         | 79     |
|   | 8. The criteria for selecting the evidence are clearly described   | 79                              | 82                         | 51                         | 75                                    | 82                                  | 71                         | 29                        | 68                                 | 61   | 39                                    | 64                         | 68     |
|   | 9. The strengths and limitations of the body of evidence are clearly described                               | 43                              | 61                         | 43                         | 68                                    | 57                                  | 93                         | 36                        | 79                                 | 75   | 54                                    | 86                         | 61     |
| 10: The methods for formulating the recommendations are clearly described             | 10. The methods for formulating the recommendations are clearly described                                    | 39                              | 54                         | 34                         | 39                                    | 54                                  | 71                         | 29                        | 39                                 | 29   | 29                                    | 68                         | 39     |
|   | 11. The health benefits, side effects, and risks have been considered in formulating the recommendations     | 36                              | 46                         | 37                         | 46                                    | 36                                  | 79                         | 61                        | 75                                 | 39   | 32                                    | 89                         | 46     |
| 12: There is an explicit link between the recommendations and the supporting evidence | 12. There is an explicit link between the recommendations and the supporting evidence                        | 57                              | 82                         | 74                         | 32                                    | 79                                  | 75                         | 75                        | 61                                 | 46   | 46                                    | 64                         | 64     |
|   | 13. The guideline has been externally reviewed by experts prior to its publication                           | 43                              | 18                         | 37                         | 43                                    | 61                                  | 93                         | 29                        | 21                                 | 25   | 21                                    | 29                         | 29     |
| 14: A procedure for updating the guideline is provided                                | 14. A procedure for updating the guideline is provided   | 61                              | 36                         | 29                         | 21                                    | 18                                  | 25                         | 61                        | 18                                 | 18   | 18                                    | 18                         | 21     |

(continues)

**TABLE 3** Individual scores for the 23 AGREE items and overall quality scores<sup>a</sup> (Continued)

| Domain                     | Agree item <sup>18</sup>   | % Total possible score for item |                            |                            |                                       |                                     |                            |                           |                                    |  |                                       |                            |        |
|----------------------------|--|---------------------------------|----------------------------|----------------------------|---------------------------------------|-------------------------------------|----------------------------|---------------------------|------------------------------------|--|---------------------------------------|----------------------------|--------|
|                            |  | ABIKUS<br>2007 <sup>21</sup>    | ACRM<br>2011 <sup>22</sup> | EFNS<br>2005 <sup>23</sup> | ANCDS<br>Memory<br>2008 <sup>24</sup> | ANCDS<br>Exec<br>2008 <sup>25</sup> | NZGG<br>2006 <sup>26</sup> | RCP<br>2003 <sup>27</sup> | ANCDS<br>Att<br>2003 <sup>28</sup> | ANCDS<br>Mem<br>Aids<br>2007 <sup>29</sup> | ANCDS<br>Assess<br>2005 <sup>30</sup> | NGWG<br>2006 <sup>31</sup> | Median |
| 4: Clarity of presentation | 15. The recommendations are specific and unambiguous   | 79                              | 79                         | 57                         | 39                                    | 75                                  | 93                         | 75                        | 50                                 | 57   | 46                                    | 75                         | 75     |
|                            | 16. The different options for management of the condition or health issue are clearly presented    | 82                              | 61                         | 74                         | 39                                    | 61                                  | 79                         | 79                        | 54                                 | 64   | 57                                    | 68                         | 64     |
| 5: Applicability           | 17. Key recommendations are easily identifiable  | 86                              | 86                         | 66                         | 61                                    | 64                                  | 96                         | 93                        | 71                                 | 29   | 46                                    | 61                         | 66     |
|                            | 18. The guideline describes facilitators and barriers to its application                           | 14                              | 18                         | 14                         | 14                                    | 14                                  | 82                         | 25                        | 29                                 | 25   | 21                                    | 18                         | 18     |
|                            | 19. The guideline provides advice and/or tools on how the recommendations can be put into practice | 14                              | 18                         | 14                         | 18                                    | 18                                  | 86                         | 32                        | 29                                 | 21   | 18                                    | 14                         | 18     |
|                            | 20. The potential resource implications of applying the recommendations have been considered       | 14                              | 18                         | 17                         | 14                                    | 14                                  | 36                         | 29                        | 14                                 | 14   | 14                                    | 21                         | 14     |
| 6: Editorial independence  | 21. The guideline presents monitoring and/or auditing criteria                                     | 21                              | 14                         | 14                         | 14                                    | 14                                  | 61                         | 18                        | 18                                 | 14   | 14                                    | 14                         | 14     |
|                            | 22. The views of the funding body have not influenced the content of the guideline                 | 50                              | 50                         | 37                         | 43                                    | 43                                  | 93                         | 61                        | 54                                 | 46   | 46                                    | 54                         | 50     |
|                            | 23. Competing interests of guideline development group members have been recorded and addressed    | 14                              | 25                         | 14                         | 14                                    | 14                                  | 79                         | 86                        | 14                                 | 14   | 14                                    | 14                         | 14     |
|                            | Overall quality of the guideline   | 57                              | 57                         | 40                         | 50                                    | 57                                  | 86                         | 61                        | 50                                 | 39   | 50                                    | 57                         | 57     |

<sup>a</sup>See expansion of all abbreviations which are defined in the main body text of Table 1.

<sup>b</sup>This guideline had 5 raters; all others had 4 raters.



obtained the highest score of all included guidelines for 17 of the 23 AGREE items and for all 6 domains. This was also the only guideline to satisfactorily address the issue of applicability (domain 5) by providing information and tools to facilitate implementation of the recommendations (Table 3).

### Appraiser agreement

Table 4 presents intraclass correlation coefficients (ICCs) for agreement among raters for the 11 guidelines evaluated. All ICCs showed high agreement (ICC > 0.80) except for 1 (moderate agreement; ICC = 0.76).

## DISCUSSION

This is the first known comprehensive search and evaluation of the methodological quality of guidelines addressing cognitive rehabilitation following TBI. Such an evaluation can aid in describing the state of the field and inform future guideline development efforts. A validated critical appraisal instrument for guidelines was used to evaluate methodological quality, and high values for agreement among raters were obtained despite use of a relatively large rater pool.

The 11 guidelines identified in this review collectively yielded 140 individual cognitive rehabilitation recommendations. The highest volume of recommendations was in the area of “assessment and principles,” with lower volumes in specific areas of cognitive rehabilitation practice. It may be that although the importance of assessing and providing multidisciplinary cognitive rehabilitation has been established, there is less evidence or agreement supporting interventions in the specific cognate areas. Alternatively, this may reflect cognitive rehabilitation interventions addressing multiple cognitive areas. A more detailed examination of the supporting literature for the

recommendations is required to definitively answer this question. The AGREE instrument focuses on the rigor of the *process* of guideline development, rather than the content of the guideline recommendations themselves. Examination of the recommendations in terms of the underpinning evidence, feasibility of implementation, and currency is beyond the scope of this review. This is covered by further articles in this series.<sup>16,32-36</sup>

A lack of information and tools to implement guideline recommendations into practice was identified as a clear shortcoming of existing TBI cognitive rehabilitation guidelines, as reflected by the very low scores at both the domain and individual item level across all guidelines other than that of the NZGG. This compromises the potential for evidence-informed recommendations to be of use to practicing clinicians and thus by extension to optimize patient outcomes and quality of life. Furthermore, lack of audit criteria limits the ability to establish whether any recommendations have translated into clinical practice, with or without the assistance of implementation strategies. Given the considerable resources invested in guideline development, it is important to ensure that the full value of guidelines can be realized and measured. Addressing these limitations should, therefore, be a high priority for future guidelines in this field.

The median score for the domain “rigor of development” was 46%. The generally low scores for items pertaining to the description of how recommendations were formulated, external peer review and procedures for guideline updating indicate that currently there are limitations in procedures for ensuring transparency, independent review, and currency of guidelines across the guidelines reviewed, or, that these have been inadequately reported. Although this information can be difficult to incorporate into guidelines published in peer-reviewed journals for space reasons, journals should consider encouraging authors to provide a summary of key points and make efforts to accommodate this information. Conversely, most guidelines performed well in the areas of systematic search and selection and description of the strengths and weaknesses of research evidence. This indicates that the clinical practice recommendations within the guidelines were generally underpinned by a thorough search for and description of research evidence. Guidelines also tended to articulate their overall objectives, scope, and audience well and produced unambiguous, clearly identifiable recommendations.

“Stakeholder involvement” and “editorial independence” were other areas in which shortcomings were identified across the guidelines appraised. Based on the AGREE appraisal scores, there are limitations in existing cognitive rehabilitation guidelines in ensuring that views and preferences of the target population are

**TABLE 4** *Appraiser agreement<sup>a</sup>*

| Guideline                         | Intraclass correlation coefficient |
|-----------------------------------|------------------------------------|
| ABIKUS 2007 <sup>21</sup>         | 0.85                               |
| ACRM 2011 <sup>22</sup>           | 0.91                               |
| EFNS 2005 <sup>b23</sup>          | 0.80                               |
| ANCDS Memory 2008 <sup>24</sup>   | 0.87                               |
| ANCDS Exec 2008 <sup>25</sup>     | 0.95                               |
| NZGG 2006 <sup>26</sup>           | 0.91                               |
| RCP 2003 <sup>27</sup>            | 0.92                               |
| ANCDS Att 2003 <sup>28</sup>      | 0.87                               |
| ANCDS Mem Aids 2007 <sup>29</sup> | 0.84                               |
| ANCDS Assess 2005 <sup>30</sup>   | 0.76                               |
| NGWG 2006 <sup>31</sup>           | 0.88                               |

<sup>a</sup>See expansion of all abbreviations which are defined in the main body text of Table 1.

<sup>b</sup>This guideline had 5 raters; all others had 4 raters.

incorporated into the guideline development. This is an important omission as patient preferences, along with research evidence and clinical experience, are foundations of evidence-based practice.<sup>37</sup> Incorporation of stakeholder input is, therefore, an important area of focus for future guidelines in this field. As articulated by the International Committee of Medical Journal Editors,<sup>38</sup> recording conflicts of interest, and where necessary addressing these conflicts, is important in ensuring public trust in the credibility of published academic research. This is an area that future guidelines should address on the basis of the current AGREE appraisals.

The AGREE II appraisal findings in this study are consistent with other published appraisals of TBI and stroke guidelines. Berrigan et al<sup>39</sup> evaluated the quality of guidelines for mild TBI care and found variability in the quality of guidelines and relatively lower scores in the areas of applicability of guidelines, consumer involvement, and editorial independence. Similarly, Rusnak et al<sup>40</sup> and Alarcon et al<sup>41</sup> found lower domain scores on editorial independence, stakeholder involvement, and applicability in AGREE ratings of severe TBI guidelines.<sup>40,41</sup> Tavender et al<sup>42</sup> and Hurdowar et al<sup>43</sup> similarly found variability across guidelines for emergency care of patients with mild TBI and stroke. As in the present study, the reviews by Tavender et al and Hurdowar et al reported that overall quality and domain scores were generally higher for the groups that routinely develop guidelines and have good processes in place, such as the Scottish Intercollegiate Guidelines Network, the National Institute for Health and Care Excellence, and the NZGG. This suggests that including experienced guideline development experts in the development process can result in higher AGREE quality ratings.

A number of factors need to be considered when interpreting the results of the AGREE quality appraisal. Some critical appraisal tools employ weighting of scores to reflect their relative importance<sup>44</sup>; however, the items in the AGREE scoring system are all given equal weight. It could, therefore, be argued that some items considered of particular importance in guideline development—for example, systematic searching for evidence—are not adequately weighted in the overall scores. Furthermore, a limitation of using the same scoring system for large, stand-alone guidelines and those published in peer-reviewed journals is that journal publications have space and word limitations that may limit reporting of information relevant to evaluation of AGREE criteria. For example, a stand-alone guideline may contain an appendix detailing conflict of interest details for all panel members; it is possible that conflict of interest declarations were recorded for the 8 guidelines published in

the peer-reviewed literature, but these items could not be scored because this information was not contained within the published article or available supporting documents. Although the 3 stand-alone guidelines (NZGG, RCP, and ABIKUS) did exhibit relatively high scores for some domains, these guidelines were not rated as the top 3 across all domains. Therefore, the variation in scores across the included guidelines is not solely a function of their publication format or length. It may be that the peer review process associated with publication of a guideline in a journal ensures greater methodological rigor than publication as a stand-alone guideline, offsetting the disadvantage of word limits imposed by journals. Furthermore, efforts were made to offset this potential limitation during the AGREE appraisal process by accessing available subsidiary documents, appendices, or other additional materials associated with a journal publication where applicable.

It is also important to note the differing scope of the identified guidelines. The 3 stand-alone guidelines covered the broad field of TBI, including cognitive rehabilitation. By contrast, the 8 published journal articles were specific to cognitive rehabilitation or areas within cognitive rehabilitation. Because of this difference in scope, it is not valid to compare or evaluate the guidelines on the basis of their scope. Finally, this review covered the period to January 2012; another relevant guideline from the Scottish Intercollegiate Guidelines Network was published in 2013<sup>45</sup> and thus could not be incorporated into the present review. The American Congress of Rehabilitation Medicine brain injury special interest group published a cognitive rehabilitation manual in late 2012, which was also not evaluated as it was not formatted specifically as a guideline and was a follow-up to the 2011 publication. This is a general limitation of all reviews, which cannot by definition encompass publications that postdate the evidence search and identification period.

## CONCLUSION

A review of guidelines addressing cognitive rehabilitation following TBI using the AGREE instrument identified 11 eligible guidelines comprising 3 stand-alone guideline publications and 8 guidelines published in peer-reviewed journals. Results of quality appraisal indicated the following:

- Existing guidelines have generally
  - employed systematic methods of searching for, selecting, and appraising research evidence underpinning clinical practice recommendations within the guidelines;
  - articulated their overall objectives, scope, and audience well; and

- produced unambiguous, clearly identifiable recommendations.
- Future guidelines should address limitations identified in this review by
  - incorporating information on how to implement recommendations and procedures for auditing adherence in clinical practice settings;
  - developing and/or reporting procedures for formulating recommendations, independently reviewing and ensuring currency of guidelines;
  - incorporating patient's preferences into guideline development; and
  - recording and addressing conflicts of interest.

## REFERENCES

1. Abelson-Mitchell N. Epidemiology and prevention of head injuries: literature review. *J Clin Nurs*. 2008;17(1):46–57.
2. Murray C, Lopez A. *Global Health Statistics*. Geneva: World Health Organization; 1996.
3. Khan F, Baguley JJ, Cameron ID. 4: rehabilitation after traumatic brain injury. *Med J Aust*. 2003;178(6):290–295.
4. Kalechstein AD, Newton TF, van Gorp WG. Neurocognitive functioning is associated with employment status: a quantitative review. *J Clin Exp Neuropsychol*. 2003;25(8):1186–1191.
5. Ponsford J, Draper K, Schonberger M. Functional outcome 10 years after traumatic brain injury: its relationship with demographic, injury severity, and cognitive and emotional status. *J Int Neuropsychol Soc*. 2008;14(2):233–242.
6. Satz P, Zaucha K, Forney DL, et al. Neuropsychological, psychosocial and vocational correlates of the Glasgow Outcome Scale at 6 months post-injury: a study of moderate to severe traumatic brain injury patients. *Brain Inj*. 1998;12(7):555–567.
7. Rimel RW, Giordani B, Barth JT, Jane JA. Moderate head injury: completing the clinical spectrum of brain trauma. *Neurosurgery*. 1982;11(3):344–351.
8. Access Economics. *The Economic Cost of Spinal Cord Injury and Traumatic Brain Injury in Australia*. Report by Access Economics Pty Limited for the Victorian Neurotrauma Initiative, Victoria, Australia. June 2009;115.
9. Faul M, Wald M, Rutland-Brown W, Sullivent E, Sattin R. Using a cost-benefit analysis to estimate outcomes of a clinical treatment guideline: testing the Brain Trauma Foundation guidelines for the treatment of severe traumatic brain injury. *J Trauma*. 2007;63(6):1271–1278.
10. Rees L, Marshall S, Hartridge C, Mackie D, Weiser M. Cognitive interventions postacquired brain injury. *Brain Inj*. 2007;21(2):161–200.
11. Glasziou P, Ogrinc G, Goodman S. Can evidence-based medicine and clinical quality improvement learn from each other? *BMJ Qual Saf*. 2011;20(suppl 1):i13–i17.
12. Lawson JH, Murphy MP. Challenges for providing effective hemostasis in surgery and trauma. *Semin Hematol*. 2004;41(1 suppl 1):55–64.
13. Field M, Lohr K. *Clinical Practice Guidelines: Directions for a New Program*. Washington, DC: Institute of Medicine: Committee to Advise the Public Health Science on Clinical Practice Guidelines; 1990.
14. Woolf SH, Grol R, Hutchinson A, Eccles M, Grimshaw J. Clinical guidelines: potential benefits, limitations, and harms of clinical guidelines. *BMJ*. 1999;318(7182):527–530.
15. Keris V, Lavendelis E, Macane I. Association between implementation of clinical practice guidelines and outcome for traumatic brain injury. *World J Surg*. 2007;31(6):1352–1355.
16. Bayley M, Tate R, Douglas JM, et al, On Behalf of the InCog Expert Panel. INCOG guidelines for cognitive rehabilitation following traumatic brain injury: methods and overview. *J Head Trauma Rehabil*. 2014;29(4):290–306.
17. Brouwers MC, Kho ME, Browman GP, et al. AGREE II: advancing guideline development, reporting and evaluation in health care. *CMAJ*. 2010;182(18):E839–E842.
18. The AGREE Next Steps Consortium. Appraisal of guidelines for research & evaluation II: AGREE II instrument 2009. <http://www.agreetrust.org>. Accessed January 24, 2014.
19. Brouwers MC, Kho ME, Browman GP, et al. Development of the AGREE II, part 2: assessment of validity of items and tools to support application. *CMAJ*. 2010;182(10):E472–E478.
20. Brouwers MC, Kho ME, Browman GP, et al. Development of the AGREE II, part 1: performance, usefulness and areas for improvement. *CMAJ*. 2010;182(10):1045–1052.
21. ABIEBR Project. ABIKUS guideline. <http://www.abiebr.com/pdf/abikus.aug.07.pdf>. Published 2007. Accessed 09 Feb 2012.
22. Cicerone KD, Langenbahn DM, Braden C, et al. Evidence-based cognitive rehabilitation: updated review of the literature from 2003 through 2008. *Arch Phys Med Rehabil*. 2011;92(4):519–530.
23. Cappa SF, Benke T, Clarke S, Rossi B, Stemmer B, van Heugten CM. EFNS guidelines on cognitive rehabilitation: report of an EFNS task force. *Eur J Neurol*. 2005;12(9):665–680.
24. Ehlhardt LA, Sohlberg MM, Kennedy M, et al. Evidence-based practice guidelines for instructing individuals with neurogenic memory impairments: what have we learned in the past 20 years? *Neuropsychol Rehabil*. 2008;18(3):300–342.
25. Kennedy MR, Coelho C, Turkstra L, et al. Intervention for executive functions after traumatic brain injury: a systematic review, meta-analysis and clinical recommendations. *Neuropsychol Rehabil*. 2008;18(3):257–299.
26. New Zealand Guidelines Group. *Traumatic Brain Injury Guidelines: Diagnosis, Acute Management and Rehabilitation*. Wellington, NZ: New Zealand Guidelines Group; 2006:244.
27. Royal College of Physicians and British Society of Rehabilitation Medicine. *Rehabilitation Following Acquired Brain Injury: National Clinical Guidelines*. London, England: Royal College of Physicians and British Society of Rehabilitation Medicine; 2003:81.
28. Sohlberg MM, Avery J, Kennedy M, et al. Practice guidelines for direct attention training. *J Med Speech Lang Pathol*. 2003;11(3):xi–xxxix.
29. Sohlberg MM, Kennedy M, Avery J, et al. Evidence-based practice for the use of external aids as a memory compensation technique. *J Med Speech Lang Pathol*. 2007;15(1):xv–li.
30. Turkstra L, Ylvisaker M, Coelho C, et al. Practice guidelines for standardized assessment for persons with traumatic brain injury. *J Med Speech Lang Pathol*. 2005;13(2):ix – xxxviii.
31. Warden DL, Gordon B, McAllister TW, et al. Guidelines for the pharmacologic treatment of neurobehavioral sequelae of traumatic brain injury. *J Neurotrauma*. 2006;23(10):1468–1501.
32. Ponsford J, Janzen S, McIntyre A, Bayley M, Velikonja D, Tate R, On behalf of the INCOG Expert Panel. Post traumatic amnesia/

- delirium: assessment and management: INCOG Recommendations. *J Head Trauma Rehabil.* 2014;29(4):307-320.
33. Ponsford J, Bayley M, Wiseman-Hakes C, et al, On behalf of the INCOG Expert Panel. INCOG recommendations for management of cognition following TBI part II: attention and information processing speed. *J Head Trauma Rehabil.* 2014;29(4):321-337.
  34. Tate R, Kennedy M, Ponsford J, et al, On behalf of the INCOG Expert Panel. INCOG Recommendations for management of cognition following traumatic brain injury part III: executive function and self-awareness. *J Head Trauma Rehabil.* 2014;29(4):338-352.
  35. Togher L, Wiseman-Hakes C, Douglas J, et al, On behalf of the INCOG Expert Panel. INCOG recommendations for management of cognition following TBI part IV: cognitive communication. *J Head Trauma Rehabil.* 2014;29(4):353-368.
  36. Velikonja D, Tate R, Ponsford J, McIntyre A, Janzen S, Bayley M, On behalf of the INCOG Expert Panel. INCOG recommendations for management of cognition following TBI Part V: memory. *J Head Trauma Rehabil.* 2014;29(4):369-386.
  37. Sackett DL, Rosenberg WM, Gray JA, Haynes RB, Richardson WS. Evidence-based medicine: what it is and what it isn't. *BMJ (Clinical Research ed).* 1996;312(7023):71-72.
  38. International Committee of Medical Journal Editors. Author Responsibilities—Conflicts of Interest. <http://www.icmje.org/recommendations/browse/roles-and-responsibilities/author-responsibilities-conflicts-of-interest.html>. Published 2014. Accessed May 9, 2014.
  39. Berrigan L, Marshall S, McCullagh S, Velikonja D, Bayley M. Quality of clinical practice guidelines for persons who have sustained mild traumatic brain injury. *Brain Inj.* 2011;25(7-8):742-751.
  40. Rusnak M, Mauritz W, Lecky F, Kaniansky M, Brazinova A. Evaluation of traumatic brain injury guidelines using AGREE instrument. *Bratisl Lek Listy.* 2008;109(8):374-380.
  41. Alarcon J, Rubiano A, Chirinos M, et al. Clinical practice guidelines for the care of patients with severe traumatic brain injury: a systematic evaluation of their quality. *J Trauma Acute Care Surg.* 2013;75(2):311-319.
  42. Tavender E, Bosch M, Pitt V, et al. Quality and consistency of guidelines for the management of mild traumatic brain injury in the emergency department. *Acad Emerg Med.* 2011;18(8):880-889.
  43. Hurdowar A, Graham ID, Bayley M, Harrison M, Wood-Dauphinee S, Bhogal S. Quality of stroke rehabilitation clinical practice guidelines. *J Eval Clin Pract.* 2007;13(4):657-664.
  44. Katrak P, Bialocerkowski AE, Massy-Westropp N, Kumar S, Grimmer KA. A systematic review of the content of critical appraisal tools. *BMC Med Res Methodol.* 2004;4:22.
  45. Scottish Intercollegiate Guidelines Network. *Brain Injury Rehabilitation in Adults*. Vol (SIGN publication no. 130). Edinburgh: Scottish Intercollegiate Guidelines Network; 2013.

## APPENDIX 1

### Databases and Web sites searched, search dates and yields

| Database and version    | Time period searched       | Searched date   | No. of citations |
|-------------------------|----------------------------|---|------------------|
| MEDLINE (OVID)          | 2000–December week 4, 2011 | January 9, 2012   | 222              |
| EMBASE (OVID)           | 2000–January 6, 2012       | January 9, 2012   | 361              |
| PsycINFO (OVID)         | 2000–January week 1, 2012  | January 9, 2012   | 89               |
| The Cochrane Library    | 2000–January 2012          | January 9, 2012   | 311              |
| CINAHL Plus (EBSCOhost) | 2000–2011                  | March 2, 2012   | 1002             |
|                         |                            | Subtotal  | 1985             |
|                         |                            | Duplicates  | 50               |
|                         |                            | Total (databases)   | 1935             |
|                         |                            | Number of full texts reviewed/shortlisted from database search                        | 42/7             |
|                         |                            | Number of full texts reviewed/shortlisted from Web searches and identified by authors | 28/9             |
|                         |                            | Number of final shortlisted from all sources  | 16               |
|                         |                            | Number excluded following expert review against all criteria                          | 5                |
|                         |                            | <b>Number of final included guidelines</b>  | <b>11</b>        |

### Websites searched

| Web site name: URL   | Search date      |
|--|------------------|
| 1. National Guideline Clearinghouse: <a href="http://www.guidelines.gov">www.guidelines.gov</a>  | January 30, 2012 |
| 2. NHMRC Clinical Guideline Portal: <a href="http://www.clinicalguidelines.gov.au/">http://www.clinicalguidelines.gov.au/</a>                                      | January 30, 2012 |
| 3. NHMRC Clinical Guideline Portal and Emergency Care Portal (Australia): <a href="http://www.nhmrc.gov.au/guidelines">http://www.nhmrc.gov.au/guidelines</a>      | January 30, 2012 |
| 4. Medical Journal of Australia Clinical Guidelines: <a href="http://www.mja.com.au/public/guides/guides.html">http://www.mja.com.au/public/guides/guides.html</a> | February 2, 2012 |
| 5. National Institute for Health and Clinical Excellence (NICE): <a href="http://www.nice.org.uk">www.nice.org.uk</a>  | February 2, 2012 |
| 6. Joanna Briggs Institute: <a href="http://www.joannabriggs.edu.au/">http://www.joannabriggs.edu.au/</a>  | February 2, 2012 |
| 7. Guidelines International Network: <a href="http://www.g-i-n.net/">http://www.g-i-n.net/</a>   | January 11, 2012 |

(continues)

## Websites searched (Continued)

| Web site name: URL   | Search date       |
|--|-------------------|
| 8. Guidelines Advisory Committee (Canada): <a href="http://www.gacguidelines.ca/">http://www.gacguidelines.ca/</a>   | February 2, 2012  |
| 9. TRIP database: <a href="http://www.tripdatabase.com">www.tripdatabase.com</a>   | February 2, 2012  |
| 10. Australian State Departments of Health and Ageing: <a href="http://www.health.gov.au/">http://www.health.gov.au/</a>   | February 2, 2012  |
| 11. Canadian Medical Association: <a href="http://www.cma.ca/index.php/ci_id/54316/la_id/1.htm">http://www.cma.ca/index.php/ci_id/54316/la_id/1.htm</a>  | February 3, 2012  |
| 12. Department of Veterans' Affairs: <a href="http://www.dva.gov.au/Pages/home.aspx">http://www.dva.gov.au/Pages/home.aspx</a>   | February 3, 2012  |
| 13. International Council of Nurses (ICN) (Int): <a href="http://www.icn.ch/">http://www.icn.ch/</a>   | February 3, 2012  |
| 14. Nursing Best Practice Guidelines (Can):<br><a href="http://www.rnao.org/Page.asp?PageID=861&amp;SiteNodeID=133">http://www.rnao.org/Page.asp?PageID=861&amp;SiteNodeID=133</a>   | January 11, 2012  |
| 15. Royal College of Nursing (RCN) (UK): <a href="http://www.rcn.org.uk/">http://www.rcn.org.uk/</a>   | January 11, 2012  |
| 16. American Academy of Pediatrics (United States):<br><a href="http://www.aap.org/en-us/Pages/Default.aspx">http://www.aap.org/en-us/Pages/Default.aspx</a>   | January 11, 2012  |
| 17. Guidelines Advisory Committee (GAC) (Can): <a href="http://www.gacguidelines.ca/">http://www.gacguidelines.ca/</a>   | February 3, 2012  |
| 18. National Health Service (NHS) Evidence (UK): <a href="http://www.nhs.uk/Pages/HomePage.aspx">http://www.nhs.uk/Pages/HomePage.aspx</a>   | January 11, 2012  |
| 19. National Electronic Library for Health (UK): <a href="https://www.evidence.nhs.uk/">https://www.evidence.nhs.uk/</a>   | January 31, 2012  |
| 20. New Zealand Guidelines Group: <a href="http://www.nzgg.org.nz/">http://www.nzgg.org.nz/</a>  | January 11, 2012  |
| 21. Scottish Intercollegiate Guidelines Network (Scotland): <a href="http://www.sign.ac.uk/index.html">http://www.sign.ac.uk/index.html</a>  | January 11, 2012  |
| 22. Brain Trauma Foundation: <a href="https://www.braintrauma.org/coma-guidelines/">https://www.braintrauma.org/coma-guidelines/</a>   | February 3, 2012  |
| 23. World Health Organization: <a href="http://www.who.int/en/">http://www.who.int/en/</a>   | January 11, 2012  |
| 24. Academy of Neurologic Communication Disorders and Sciences:<br><a href="http://www.ancds.org/index.php?option=com_content&amp;view=article&amp;id=9&amp;Itemid=9#TBI">http://www.ancds.org/index.php?option=com_content&amp;view=article&amp;id=9&amp;Itemid=9#TBI</a> | March 7, 2012     |
| 25. Google (first 50 Web sites screened): <a href="http://www.google.com.au">http://www.google.com.au</a>  | February 17, 2012 |
| 26. Google Scholar (first 50 websites screened): <a href="http://scholar.google.com.au/">http://scholar.google.com.au/</a>   | March 5, 2012     |

## APPENDIX 2

## Search Strategy Example: Medline (OVID)

1. exp Brain Injuries/
2. exp Craniocerebral Trauma/
3. exp Brain Edema/
4. exp Glasgow Coma Scale/
5. exp Unconsciousness/
6. exp Cerebrovascular Trauma/
7. ((head or crani\$ or cerebr\$ or capitis or brain\$ or forebrain\$ or skull\$ or hemispher\$ or intra-cran\$ or inter-cran\$) adj3 (injur\$ or trauma\$ or lesion\$ or damag\$ or wound\$ or destruction\$ or oedema\$ or edema\$ or fractur\$ or contusion\$ or concus\$ or commotion\$ or pressur\$)).ti,ab.
8. ((head or crani\$ or cerebr\$ or brain\$ or intra-cran\$ or inter-cran\$) adj3 (haematoma\$ or hematoma\$ or haemorrhag\$ or hemorrhag\$ or bleed\$ or pressure)).ti,ab.
9. exp Glasgow Outcome Scale/
10. (Glasgow adj3 scale).ti,ab.
11. "rancho los amigos scale".ti,ab.
12. ("diffuse axonal injury" or "diffuse axonal injuries").ti,ab.
13. "persistent vegetative state".ti,ab.
14. ((unconscious\$ or coma\$ or concuss\$) adj3 (injur\$ or trauma\$ or damag\$ or wound\$ or fracture\$ or contusion\$ or haematoma\$ or hematoma\$ or haemorrhag\$ or hemorrhag\$ or bleed\$ or pressure)).ti,ab.
15. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14
16. Practice guideline.pt.
17. guideline.pt.
18. exp guideline/
19. Health Planning Guidelines/
20. 16 or 17 or 18 or 19
21. 15 and 20
22. limit 21 to yr = "2000 -Current"