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Aim:

A systematic review to identify which mood and depression measures are valid for use with people with severe cognitive and communication impairments following severe acquired brain injury.

Method:

A systematic search of Cochrane, Web of Science, Ovid and EBSCOhost was performed in March 2020, July 2021 and September 2022. The search focused on self-report and observer-rated assessment tools used to assess mood, depression and/or distress in those described as having a severe acquired brain injury. Psychometric properties were extracted using the Consensus-based standards for the selection of health measurement instruments (COSMIN) risk of bias checklist. Qualitative synthesis was performed on extracted patient data.

Results:

19 papers detailing the psychometric properties of 25 measures were included, involving 2,914 participants. Nine papers provided details confirming the severity of participants’ cognitive and communication impairments. The remaining papers...
described including severely injured participants but provided limited details so that precise level of severity could not be confirmed. Only one paper showed evidence of adequate psychometric properties and included those with severe cognitive impairments in a study of two observer-rated measures, the Stroke Aphasia Depression Questionnaire (10 item) and the Aphasia Depression Rating Scale.

Conclusions:

Due to the exclusion of individuals with severe cognitive and communication consequences following brain injury, no studies using self-report measures showed adequate validity evidence to recommend their use in this population. A small study using two observer-rated scales included those with severe cognitive impairments and showed satisfactory evidence that these measures can be validly used with this population.
A systematic review of mood and depression measures in people with severe cognitive and communication impairments following acquired brain injury.

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Introduction

Distress, low mood, and depression are common following acquired brain injury [1], [2]. However, due to the overlap of symptoms of depression and the cognitive and physical consequences caused by brain injury (such as slowed processing, changes in sleep, appetite, or ability to engage in activities), it can be challenging to recognise mood difficulties after acquired brain injury [3]. When the brain injury and its consequences are severe, the assessment of mood becomes more complex. This review focuses on the assessment of mood in people with severe and persistent impairments in cognition and communication following a brain injury [4-6].

Low mood is traditionally assessed using self-report measures [7-10] which require cognitive abilities such as reflecting on the past, comparing mood states and comprehending complex and often abstract concepts such as mood, time, intensity and ‘normal’ versus ‘abnormal’. This makes them difficult to apply when cognitive and communication impairments are present. Other methods, such as observational measures, can also be challenging to use as mood-related behaviours may be clouded by the neurological symptoms of the brain injury, making it difficult to identify whether a mood issue is present.

To increase the likelihood of patients being offered proportional and appropriate treatment, it would be useful to clarify which mood assessment measures are valid for use with those with ongoing severe cognitive and communication impairments following a brain injury. Therefore, a systematic review of the evidence was undertaken. To the authors’ knowledge, no previous systematic review of mood measures for the population of people with severe brain injury has been completed.
Objectives

The objectives of the systematic review were to establish:

- Which studies examining the validity of tools for the assessment of mood, distress, and depression in acquired brain injury include people with severe brain injury with persistent severe cognitive and communication impairments in their studies?
- How was severity defined by authors of the studies and what details regarding the degree of impairment of cognition and communication were provided?
- Which, if any, tools have been found to be reliable and valid measures of mood, distress and depression when used with brain injured individuals with severe cognitive and communication impairments and what is the quality of the evidence for their reliability and validity?

Method

A systematic review of the literature based upon a pre-registered protocol (PROSPERO identifier: CRD42019162649) was conducted according to PRISMA standards [11]. The University of Glasgow maintained responsibility for the integrity and conduct of this review. This study was part of a PhD project funded by the Francis and Augustus Newman foundation. Scoping studies were performed in December 2019 and January 2020 to ascertain the sensitivity of the terms and associated abbreviations for “depression”, “mood”, “brain injury”, and “assessment”. Initial scoping searches of validation studies showed that the term “severe brain injury” was not fully or consistently defined in published studies. It was also noted that although authors of papers described the included population as “severe”, patients with
severe comprehension impairments were often excluded from validation studies and the exclusion was not always explicitly stated. Limiting search terms to those papers including the term “severe” was too restrictive and did not retrieve relevant papers. Additionally, limiting searches to titles excluded key papers in the literature. Thus, a broad search was applied in order to capture the appropriate literature and avoid missing relevant papers. Search terms were refined and searches were completed in March 2020 and repeated in July 2021 and September 2022 (see appendix II for detailed search terms).

The following databases were searched from inception:

- Cochrane Library: Cochrane Database for Systematic Reviews (CDSR) & Cochrane Central Register of Controlled Trials (CENTRAL)
- Web of Science: Core collection & MEDLINE databases
- Ovid: Health and Psychosocial Instruments & Embase databases
- EBSCOhost: CINAHL, PsycARTICLES, PsycINFO & Psychology and behavioural sciences database

This was supplemented by hand searching the references in the identified papers and any review papers on similar topics. The emphasis of the review was on published, peer-reviewed journals. Grey literature beyond articles derived from hand searched articles was not included. There were no restrictions in terms of the language of the published studies.

Initial inclusion/exclusion criteria

Quantitative studies including standardisation studies, validation studies, diagnostic studies, cohort studies, case control studies, experiments and randomised control trials were included, if a method for mood assessment or measurement was used within the study.
Papers that were not investigating the validity of the mood measure, or where data regarding the validity of the measure could not be extracted, were excluded.

Adult population studies (aged 18 or over) with acquired brain injury (inclusive of stroke, traumatic brain injury, hypoxic injury and other forms of non-progressive brain injury) were included. Paediatric populations and adolescent populations (under the age of 18) and progressive neurological conditions (e.g. Parkinson’s disease, multiple sclerosis and dementia) were excluded.

Studies were selected if 1) the study population was defined by the study authors as adults with severe brain injury, or 2) the severity of injury was listed as a Glasgow Coma Scale (GCS) score of 8 or less, and/or post traumatic amnesia (PTA) period of more than 1 day and/or 3) there was evidence of the presence of severe cognitive difficulties and/or cognitive communication difficulties.

Papers focussed exclusively on individuals with mild to moderate brain injuries were excluded. In cases where the severity of the acquired brain injury population was not detailed fully, was unclear or severity was mixed, papers were excluded if 1) less than 50% of the population was defined as having a severe brain injury, 2) the authors excluded participants who had impaired language, comprehension, or orientation, or the authors stated that participants were excluded if they were unable to complete mood and/or other measures, or 3) the reported cognitive assessment results or screening test results demonstrated the population had mild to moderately impaired cognition. All aspects of title searching, data extraction, risk of bias assessment and analysis were performed by the principal researcher (AR). An additional researcher (SC) acted as a second reviewer for a randomly selected 10% of the screening.
Evaluation of methodological quality

The COSMIN (COnsensus-based Standards for the selection of health Measurement INstruments) risk of bias checklist (RoB) was used to examine the methodological qualities of the included studies based on the available information provided by the authors [12]. A four-point rating scale is used to rate the quality of each study (‘very good’, ‘adequate’, ‘doubtful’, or ‘inadequate’) using a “worst score counts” approach [12]. Following completion of the risk of bias rating for the studies, each measure is rated using the criteria of good measurement properties as either sufficient (+), indeterminate (?) or insufficient (-) [13-15]. COSMIN suggest that outcome measures be chosen if there is evidence of a) sufficient content validity and b) at least low quality evidence of sufficient internal consistency. They should not be recommended for use if they have high quality evidence of an insufficient measurement property. Outcome measures can be tentatively recommended with suggestions for further research if they do not fall within the previously mentioned criteria (i.e. have mixed sufficient or indeterminate results) [13].

As there is no clear outcome measure that is considered a gold standard in this field, structured diagnostic interviews were accepted as the gold standard. In relation to construct validity (box 9), it was decided that correlations with other (established) instruments measuring mood should be ≥ 0.50, that correlations with instruments measuring unrelated constructs should be <0.30 and the area under curve (AUC) should be ≥ 0.70, as per suggestions made by the COSMIN manual [12].

Results

The initial searches yielded 20,606 articles. After duplicates were removed electronically via the Endnote database, 15,350 articles remained. Following systematic title and abstract
screening, 72 articles were screened at full text level. 16 articles were retained for inclusion and, following a citation search, an additional three papers were included. Repeat searches in 2021 and 2022 did not yield any additional papers (See Figure 1). The final 19 articles, involving 2,914 participants, were included for analysis of risk of bias using the COSMIN Risk of Bias checklist (see Table 1).

The included papers provided details on 25 measures of mood and depression (descriptions of these measures are provided in Table 2). Of these measures, 15 are self-report (completed by the patient) and 10 are observer or clinician rated. One of the measures described (Leeds Depression scale) is now obsolete and no longer used in practice. Of the included measures, 10 were specifically developed for a brain injury population. The remaining measures were developed from psychiatric assessment based on the Diagnostic and Statistical Manual of Mental Disorders (DSM), or psychological models of depression, and were originally intended for use with the general or psychiatric patient population (Table 2). Eight papers used the accepted gold standard (structured diagnostic interview by a psychiatrist according to Diagnostic and Statistical Manual of Mental Disorders criteria).

The psychometric properties of the studies on all the instruments including risk of bias ratings for each study are detailed in Table 1. Due to the heterogeneity of the included acquired brain injury populations and the varied measures used as the gold standard, it was decided that meta-analysis was not appropriate and a narrative summary was completed. Additional data on population, location and sample size was extracted. Of particular relevance to this review, data on the number of participants considered “severe” and how this severity was established was extracted.

Severity
Severity of the acquired brain injury was adequately described in six papers (details provided on Glasgow Coma Scale or post traumatic amnesia scores) [18, 21, 23, 25, 28, and 32]; one paper reported on disability outcome measures [24], the remaining twelve papers reported that they did not exclude severe acquired brain injury patients, but did not fully specify the severity of their included patient population meaning that the percentage that had severe cognitive impairments could not be established. These twelve papers were included as they did not report excluding patients who were severely impaired so could not be excluded from the review. However, the validity of the measures with severely impaired patients cannot be confidently determined from these papers as they had mixed severity participants.

Structural validity

Structural validity, the degree to which scores on a scale reflect the unidimensionality of the construct being measured, was examined in studies of five measures (Table 1). Two papers, examining the Beck Depression Inventory-II (BDI-II) and the Depression and Anxiety Severity Scale-21 (DASS-21), calculated a statistic deemed appropriate by COSMIN ([19] and [23]) and met criteria for a ‘sufficient’ rating. Despite the Beck Depression Inventory-II study being rated as unbiased and having a sufficient rating, it must be noted that the authors suggested an 18 item measure for unidimensionality (removing 3 items that related to the somatic features of depression) [19]. The authors examining the Depression and Anxiety Severity Scale-21 recommended a four factor structure (depression, anxiety, stress and general distress) based on their examination of the records of 504 traumatic brain injury patients. Their method of examining records limited the ability to extract information on the cognitive impairments of those being assessed using this self-report measure. Four of the studies examining structural
validity noted somatic symptoms or pain as a separate factor within the measure, which is likely be an important consideration when assessing individuals post brain injury.

Internal consistency, reliability, measurement error and responsiveness

Internal consistency, the degree that items are interrelated, was reported in 12 studies on ten measures. Nine of these studies were rated as ‘sufficient’ and had low risk of bias (Table 1). Six studies reported on test-retest reliability of measures, of which only one study examining the Signs of Depression Severity Scale was found to be ‘sufficient’, although this result was of low quality due to its risk of bias [34]. One study reported measurement error (how close the scores of repeated measurements in stable patients are) [32] which was found to be inadequate due to scores not being stable. Due to the lack of reporting of the details required by COSMIN standards neither of the two papers reporting on responsiveness of the Aphasia Depression Rating Scale and Visual Analogue Mood Scale [16] or Depression Intensity Scale Circles [24] were found to be sufficient.

Criterion validity and construct validity

Criterion validity is the degree to which the scores of a measure reflect those of the gold standard. Six papers reported on criterion validity, one of which was ‘sufficient’ [18]. Eight papers reported on construct validity. Of these, four studies were found to be ‘sufficient’ with low risk of bias [17, 21, 28 and 32].

Risk of bias

A number of the studies were found to be at high risk of bias according to COSMIN criteria. This was due to factors such as small sample size, lack of detail on whether environments were controlled in test-retest, inappropriate statistical methods, inadequate time interval between repeat measures and bias in comparing subgroups ([16, 21,24, 25, 26, 29, 32, 33,
and 34] Table 1). For many of these studies, a lack of detail about the statistical methods used and specific details in reporting of results required resulted in lower ratings. Later studies appeared to more frequently report their findings in line with COSMIN requirements, which may indicate improved quality of studies, or more likely, improved standards of reporting.

Adaptations

It was noted that in a number of the included studies it was explicitly stated that the recommended method of administration of the measures was adapted to compensate for patients’ access and understanding difficulties such as visuospatial impairments, low education levels and slow processing speed [18, 21 and 24]. This included reading the measures to patients and prompting them for answers, taking additional time and using large print or printed responses to prompt participants. These adaptations arguably change the original instructions and therefore may impact the validity of these measures. Specifically, if they are adapted and administered at the same time as the clinical interview, there may be a high risk of bias.

Quality of psychometric properties

Regarding the psychometric properties of the measures used in studies with populations with unspecified severity of cognitive and communication impairment, six papers showed high quality and sufficient results (Table 1). These studies examined the Aphasia Depression Rating Scale (very good internal consistency and hypothesis testing for construct validity, both rated as sufficient) [17]; the Depression Anxiety Severity Scale 21 item (very good structural validity and internal consistency, both rated as sufficient) [23]; the Stroke Aphasia Depression Questionnaire 10 item (two studies finding very good and sufficient internal consistency [17 and 30] and adequate hypothesis testing for construct validity of sufficient or indeterminate
quality); the Stroke Aphasia Depression Questionnaire Hospital version [30] (with very good and sufficient internal consistency and hypothesis testing of construct validity); the Traumatic Brain Injury Quality of Life scale and the Patient Health Questionnaire 9 item (both with very good and sufficient hypothesis testing of construct validity) [28]; the Beck Depression Inventory-II (with adequate and sufficient structural validity)[20]; the Visual Analogue Mood Scale and the Visual Analogue Self Esteem Scale [30](both with very good and sufficient internal consistency and adequate hypothesis testing for construct validity rated as indeterminate); and the Hamilton Depression Scale, Hospital Anxiety and Depression Scale and Beck Depression Inventory [18] (all showing very good and sufficient criterion validity).

Discussion

This review examined the psychometric properties of 25 mood measures reported in 19 studies of validity in people with severe or mixed severity acquired brain injury. A range of psychometric properties was reported and results ranged from “inadequate” to “very good”.

Due to the heterogeneity of the populations, variability in choice of gold standard as well as the mixed results of studies on the same measures, it was not possible to pool the results. Research on stroke and research on traumatic brain injury are seen as separate fields due to the nature of prognosis and recovery patterns. This makes it challenging to find research on the impact of shared symptoms i.e. cognitive impairments experienced due to neurological damage sustained due to the acquired brain injury.

The challenges of assessing mood after brain injury were seen in different ways in the selected papers. It was noted that the structural validity of the Depression Anxiety Severity Scale
(DASS-21) and Stroke Aphasia Depression Questionnaire (SADQH-10-10) improved when somatic items were removed, possibly highlighting how these somatic symptoms overlap with physiological sequelae of acquired brain injury and may not specifically map on to mood related issues. Papers examining observer or clinician rated studies alluded to the issue of using measures with those with severe cognitive and communication impairments, stating that the need for the use of other-rated measures was due to issues with reliability when asking patients to complete self-report measures, usually in the context of communication impairment and aphasia [17, 30]. The authors of the Depression Intensity Scale Circles recognized that although the measure is designed to be used with the severely cognitively impaired, that the group with whom validity was examined had “relatively high skills and could complete (self-report measures)” [24]. This further illustrates how the use of these measures require consideration in those with ongoing sequelae following their brain injury.

In completing this review it was noted that there were inconsistencies in how the term “severe” was used or operationalised by authors. Although authors defined the population as being “severe”, very few of them considered participants’ cognitive abilities and appeared to report on the severity of the acute injury as opposed to the associated impairments. In a study reporting on “severely injured” patients’ performance [34] the mean mini-mental status examination (MMSE) score was reported as 24/30 (25 and above is considered “normal”). This would indicate that the sample likely had moderate cognitive impairment rather than severe and that the studies were unlikely to have included the target population for this review. It was apparent that in many studies where the population was described as having a “severe” brain injury, the included patients had sufficient cognitive abilities to complete self-report measures via the reported administration (e.g. over the phone, patients returning measures independently via post, or patients providing informed consent). Papers tend to
focus on injury severity and levels of consciousness at the time of the injury rather than the
consequences of the acquired brain injury.

The lack of consistent reporting on the severity of the brain injury and the lack of
consideration of those with ongoing severe cognitive and communication impairments
highlights the paucity in research findings for this population. The authors of this paper who
work clinically with people with severe cognitive and communication impairments following
brain injury recognise that this population is not well defined in the literature and further
studies need to better define this population. This lack of consistency in reporting also
resulted in increased challenges in reviewing papers and reduced ability to synthesise results.
Transparency in study inclusion and exclusion criteria is needed to improve the
interpretability of data regarding patient populations in brain injury research. Researchers
should consider including cognitive screens or assessments to determine the cognitive
abilities of their study population, as the Glasgow Coma Scale and post-traumatic amnesia
scores do not adequately measure persistent cognitive and communication impairments.

According to COSMIN guidance, the following measures appear to have robust evidence to
support their use with people with mild to moderate brain injuries: the Aphasia Depression
Rating Scale (ADRS), Depression Anxiety Severity Scale (DASS-21), Stroke Aphasia Depression
Questionnaire (SADQH-10, SADQ-10, SADQH), Visual Analogue Mood Scale (VAMS) and Visual
Analogue Self Esteem Scale (VASES). Although these measures have sufficient evidence for
use with a less impaired acquired brain injury population, the available evidence does not
show consistent or comprehensive results for use with those with severe cognitive and
communication impairments following acquired brain injury which puts limitations on their
recommendation for this population. Additionally, there were issues regarding adapted
administration of measures to compensate for cognitive impairments, without consideration of how this impacts validity.

In terms of severe brain injury and the target population of this review, one study, which examined the Stroke Aphasia Depression Questionnaire (SADQ-10) and the Aphasia Depression Rating Scale (ADRS) [17], showed evidence of sufficient psychometric properties of both measures and explicitly included those with severe cognitive impairments by examining patients with aphasia that limited their reliability in completing measures. While we tentatively recommend these two measures as appropriate clinician-rated measures for assessing mood in those with severe acquired brain injury, it should be noted that these results were with stroke patients only and that the sample size was very small (n=25) and thus may not be generalisable. Due to the mixed results, heterogeneous populations and lack of detail provided on severity, further validity studies on observer measures in a patients with evidence of severe cognitive/communication impairment are required. No self-report measures met criteria for recommendation.

A strength of this review is that a broad literature was searched, from database inception, which increased the likelihood that relevant papers were included. Additionally the use of the COSMIN framework to extract relevant measurement properties and examine risk of bias increased confidence in interpreting the results of the included studies.

A limitation is the majority of the searches and data extraction was completed by one researcher (AR), although reliability of study selection was established with a second reviewer (SC) at several points of the review. The cut-off of 50% of the population being considered to have suffered severe acquired brain injury may have eliminated studies on small numbers of
relevant patients, however, results from these studies would likely be less generalisable. The heterogeneity of the included studies limited synthesis of results.

Conclusions

This review presents the psychometric properties of several measures of mood. However, very few can be recommended for use with people with ongoing severe cognitive and communication impairments following acquired brain injury. In particular, no self-report measures can be recommended for this population. The validity of one measure specifically designed for use with those with severe cognitive and communication impairments (Depression Intensity Scales Circles) has not been examined on the target population and further studies are recommended.

Clinician and observer rated measures are likely to be more appropriate in this population. The Stroke Aphasic Depression Questionnaire (10-item) and the Aphasia Depression Rating Scale showed sufficient internal consistency and construct validity in relation to assessment of patients with communication impairments and aphasias. Further studies of observer- and clinician-rated studies with larger sample sizes and other acquired brain injury populations are recommended.

Additionally, this review highlighted the issue with the definition of “severity” and that a severe brain injury and severe consequences of a brain injury are separate constructs and future research should provide clearer details when referring to “severity”. The standardisation of reporting with regards to the severity of the longer-term consequences of
acquired brain injury for studies and agreement of a gold standard for use in the brain injury population would improve the interpretability of studies for future reviews.

Considering the current paucity of the evidence base, we recommend that patients with severe cognitive and communication impairments be assessed with caution using multiple sources of information (e.g. behavioural observation and collateral information) as well as clinician or observer rated measures such as the Stroke Aphasic Depression Questionnaire (10 item) or Aphasia Depression Rating Scale.

Clinical messages

- Mood and depression screens have not been sufficiently validated for use with those with severe cognitive and communication impairments following acquired brain injury.

- No self-report measures can be recommended for use with this population.

- Two observer rated mood scales (the Stroke Aphasic Depression Questionnaire 10 item and Aphasia Depression Rating Scale) can tentatively be recommended for screening mood issues in those with severe cognitive and communication impairments following acquired brain injury.

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Author contributions

Alexandra Rose: Conceptualisation, Design, Data collection, Data Extraction, Writing-Original draft preparation, Editing and Final review of manuscript; Dr Breda Cullen, PhD: Visualisation, Design, Final review of manuscript and Supervision; Dr Sarah Crawford, PhD: Visualisation, Design, Data Reviewing as second reviewer, Editing, Final review of manuscript and Supervision; Professor Jonathan Evans, PhD: Visualisation, Design, Manuscript Reviewing, Final editing and review of manuscript, and Supervision.

Declaration of conflicting interests

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Supplemental material

All material for this article has been made available for publication.
References


Table 1: Description of severity, methodological quality and COSMIN rating of included studies [35]

<table>
<thead>
<tr>
<th>Measure</th>
<th>Authors</th>
<th>sample (n severe ABI), setting, time after ABI</th>
<th>Measure of severity</th>
<th>Rate of depression</th>
<th>Gold standard</th>
<th>Methodological Quality</th>
<th>Rating</th>
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<tbody>
<tr>
<td>ADRS</td>
<td>Benaim et al (2010). [16] France</td>
<td>49 stroke (nm, 23 Aphasic), Rehabilitation centre, 66+-39 days</td>
<td>Not specified by authors. Answers of 18% considered “doubtful” and sensitivity to change improved if these were excluded</td>
<td>43% depressed according to Psychologist.</td>
<td>Psychologist interview</td>
<td>• Responsiveness – Doubtful Day 0: r = 0.65, p &lt; 10-6; Day 30: r = 0.64, p &lt; 10-3)</td>
<td>Responsiveness</td>
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<td></td>
<td>Laures-Gore et al (2017).[17] USA</td>
<td>25 stroke (nm, all aphasic), SLT referrals, 2.70 years</td>
<td>Not specified by authors. 1 patient had very severe aphasia, 4 had severe aphasia. 3 unable to complete self-rating scale.</td>
<td>10/23 on ADRS, 12/24 on SADQ-10, 10/25 met threshold on both scales</td>
<td>None, using diagnosis of depression as marker</td>
<td>• Internal consistency - Very good Cronbach’s alpha= 0.671, 0.742 with removal of item 9 &amp; 10</td>
<td>Internal consistency</td>
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<td>• Hypothesis testing – Adequate Positive correlation with SADQ-10 scores (r=0.708, p&lt;0.001).</td>
<td>Hypothesis testing</td>
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<td>BDI</td>
<td>Schwarzb old et al (2014). [18] Brazil</td>
<td>46 TBI patients, intensive care, (n=46), 25 months (13-22.3)</td>
<td>GCS of &lt;8 Assessed in chronic phase. 13 patients could not be located or assessed</td>
<td>30.4% depressed</td>
<td>SCID interview DSM-IV</td>
<td>• Criterion validity – Very good AUC=0.946, p&lt;0.0001</td>
<td>Criterion validity</td>
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<td>BDI-II</td>
<td>Siegert et al, (2010). [19] UK</td>
<td>315 inpatient, (nm), Rehabilitation unit, 1month-25years (6 months)</td>
<td>Not specified by authors. Extreme scores excluded in Rasch analysis – unclear if related to ability to complete</td>
<td>N/A</td>
<td>None</td>
<td>• Structural validity – Very good Chi Square= 86 (df72), p=0.115. (*removal of items 18,16 &amp; 21- appetite, sleep and interest in sex) [16]</td>
<td>Structural validity</td>
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<td><strong>measures</strong></td>
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<td>Siegert et al, (2009).</td>
<td>Adequate</td>
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<td>Not specified by authors. Scores were calculated for 315 patients. Missing data on remainder – not clarified. Administered by psych/SLT and adapted</td>
<td>11 items</td>
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<td>and somatic subscale (8 items</td>
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</table>
| 2 factor solution (chi square difference = 0.551, p>.25) [17]
<p>| CES-D | Adequate | 0.8195 |
| Bush et al, (2004).[21] | 4 factor structure analysis accounts for 56.01% of variance. 1. Dysphoric affect, and somatic and retarded activity items. 2. Interpersonal difficulties and dysphoric affect. 3. All 4 positive affect items. 4. 3 somatic and retarded activity items – decreased appetite, decreased talking, increased crying. | 0.8284 |
| GCS 3-8. Measures were self-report unless visual difficulties, a “few” were read to subjects by examiner | 4 factor structure analysis accounts for 56.01% of variance. 1. Dysphoric affect, and somatic and retarded activity items. 2. Interpersonal difficulties and dysphoric affect. 3. All 4 positive affect items. 4. 3 somatic and retarded activity items – decreased appetite, decreased talking, increased crying. | 0.8284 |
| CGI-S | Adequate | 0.673, p&lt;0.0001, MMPI-II D (r=0.579, p=0.15 and T scores (r=0.536, p=0.027). | 0.8284 |
| Laska et al, (2007). | Very good | Sensitivity: (Baseline=0.33, 1 month = 3, months= 0.75, 6 months =1); specificity: (Baseline=0.97, 1 month=0.93, 3 months = 0.94, 6 months = 0.92) PPV: (Baseline=0.33, 1 month = 0.58, 3 months = 0.43, 6 months=0.50) | 0.8284 |
| DASS-21 | Very Good | 0.89 |
| Randall et al, (2017). | Quadrupartite model best fit – Depression, Anxiety, | 0.8284 |</p>
<table>
<thead>
<tr>
<th>Country</th>
<th>Patient Source</th>
<th>Time Since Onset</th>
<th>Time Since Rehabilitation</th>
<th>Psychological Measure</th>
<th>Test Details</th>
<th>Internal Consistency</th>
<th>Hypothesis Testing</th>
<th>Reliability Testing</th>
<th>Responsiveness</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Rehabilitation patients, (nm), measures completed within 2 years of TBI</td>
<td>&gt;24 hours PTA, (29 &gt;4 weeks PTA). 11 inpatients, 8 completed rehab, 20 outpatients.</td>
<td>hours to 183 days (mean = 26.84, SD=27.92), “the current sample was generally representative of moderate to severe TBI”. PTA 1-4 weeks (47.82%), &gt;4 weeks (32.34%)</td>
<td>Stress, general distress (Mean discrepancy= 779.75; CMIN/DF=2.07; CFI=&gt;0.95; RMSEA=0.047; GFI=0.94; SRMR=0.029)</td>
<td>• Internal consistency – Very Good Good fit for all 4 scales (&gt;0.80). Factor structures inter-correlate (p&lt;.001) Strong relations between Depression &amp; Anxiety subscales (r=0.73), Depression &amp; Stress subscales (r=0.80) and Anxiety &amp; Stress subscales(r=0.73).</td>
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<td>UK</td>
<td>Turner-Stokes et al, (2005).</td>
<td>114 (nm) ABI rehabilitation patients, median time since onset was 12 weeks</td>
<td>FIM+FAM assessments were available for 84 patients, showed moderate to severe difficulties, cognitive subscale score median 25 (IQR 20-32, 35=unaffected); “in this cohort patients had relatively high skill and able to complete BDI-II, NGRS &amp; be categorised by DSM-IV interview”</td>
<td>43 cases (39.8%)</td>
<td>BDI-II, DSM-IV</td>
<td>• Reliability – Doubtful Inter-rater, N=66, quadratic weighted Cohen’s k, DISCS k=0.84, NGRS k=0.84. • Hypothesis testing – Adequate DISCS= ρ=0.87, (NGRS), ρ=0.66 (BDI-II), ρ=0.59 (DSM-IV), NGRSP=0.65 (BDI-II), ρ=0.59 (DSM-IV) • Responsiveness – Doubtful N=44, DISCS correlate with NGRS Spearman’s ρ=0.77, p&lt;0.001, and BDI-II (ρ=0.38, p&lt;0.01)</td>
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<tr>
<td>Australia</td>
<td>Kinsella et al, (1988).</td>
<td>39 rehabilitation patients (n=39), within 2 years of ABI</td>
<td>&gt;24 hours PTA, (29 &gt;4 weeks PTA).</td>
<td>None</td>
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<tr>
<td>Scale</td>
<td>Authors</td>
<td>Country</td>
<td>Sample</td>
<td>Data Collection</td>
<td>Measure</td>
<td>Reliability</td>
<td>Criterion Validity</td>
<td>Structural Validity</td>
<td>Reliability Hypothesis Testing</td>
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<td>GMS</td>
<td>Lightbody et al, (2006). [26] UK</td>
<td>28 hospital inpatients (nm), 14-28 days post stroke.</td>
<td>Not specified by authors. Report including severe cog/comm participants with relative/carer assent. Severity measured by RBMT – Proxy rating used for 7/28 (25%)</td>
<td>PCD = 7/28 (25%), GMS=12/28(43%), MADR=13/24(54%)</td>
<td>Psychiatrist assessment according to ICD-10</td>
<td>-</td>
<td>Criterion validity - Doubtful Kappa 0.40, 95% CI 0.04-0.67. Sensitivity of 71% (CI 29-96%), Specificity of 67% (CI 43-85%), PPV of 2% (CI 15-72%) and NPV of **% (CI 62-98%). Overall efficiency (proportion correctly identified as positive or negative) 68% (CI 48-84%)</td>
<td>Structural validity – Adequate Using Eigenvalue&gt;1; 3 factor structure accounts for 58.1% of variance (2 items loading on 3rd factor). Factor 1 =5.29; factor 2=1.70; factor 3=1.14 [22]</td>
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<td>HADS</td>
<td>Dawkins et al, (2006). [27] UK</td>
<td>140 ABI patients at neurorehabilitation centre, (n=76), mean time since injury 4.1 years (0.03-33.4 years)</td>
<td>Length of PTA or GCS (not fully detailed).</td>
<td>N/A</td>
<td>None</td>
<td>-</td>
<td>-</td>
<td>Structural validity</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Schwarzb old et al (2014). [18] Brazil</td>
<td>46 TBI patients, intensive care, (n=46), 25 months (13-22.3)</td>
<td>GCS of &lt;8 Assessed in chronic phase. 13 patients could not be located or assessed</td>
<td>30.4% depressed</td>
<td>SCID interview DSM-IV</td>
<td>-</td>
<td>Criterion validity - Very good AUC=0.947, p&lt;0.0001 [15]</td>
<td>-</td>
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<td></td>
<td>Schwarzb old et al (2014). [18] Brazil</td>
<td>46 TBI patients, intensive care, (n=46), 25 months (13-22.3)</td>
<td>GCS of &lt;8 Assessed in chronic phase. 13 patients could not be located or assessed</td>
<td>30.4% depressed</td>
<td>SCID interview DSM-IV</td>
<td>-</td>
<td>Criterion validity - Very good AUC=0.89, p&lt;0.0001 [15]</td>
<td>-</td>
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<tr>
<td>LEEDS</td>
<td>Kinsella et al, (1988). [25] Australia</td>
<td>39 rehabilitation patients (n=39),within 2 hours PTA, (29 &gt;4weeks PTA). 11 inpatients, 8 completed rehab, 59% considered &quot;case &quot;level for psychiatric</td>
<td>None</td>
<td>-</td>
<td>-</td>
<td>Reliability – Doubtful Test re-test scores correlations in the range of, r=0.67-0.92 (n=20) [23]</td>
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<tr>
<th>Scale</th>
<th>Description</th>
<th>Patients</th>
<th>Sample Characteristics</th>
<th>Concurrent validity</th>
<th>Criterion validity</th>
<th>Hypothesis testing</th>
<th>Internal consistency</th>
</tr>
</thead>
<tbody>
<tr>
<td>MADRS</td>
<td>Lightbody et al, (2007). UK</td>
<td>28 hospital inpatients (nm), 14-28 days post stroke. Not specified by authors. Report including severe cog/comm participants with relative/carer assent. Severity measured by RBMT – Proxy rating used for 7/28 (25%)</td>
<td>PCD = 7/28 (25%), GMS=12/28(43%) MADR=13/24(54%)</td>
<td>Psychiatrist assessment according to ICD-10</td>
<td>Kappa 0.60, 95%, CI 0.04-0.67 Sensitivity of 100% (CI 59-100), Specificity of 65% (CI 38-86%), PPV of 54% (CI 25-81%), NPV 100% (CI 53-90%). Overall efficiency (proportion correctly identified as positive or negative) 75% (CI 53-90%)</td>
<td>Hypothesis testing - Doubtful Concurrent validity - Correlated with observer completion of scale, r=0.658, p=0.00 [23]</td>
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<td>PHQ-9</td>
<td>Cohen et al, (2018). USA</td>
<td>381 TBI patients in rehabilitation hospitals (54.3% severe), variable time since injury. Not specified by authors. “Confirmed with medical records”.</td>
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<td>SADQ-10</td>
<td>Laures-Gore et al (2017). USA</td>
<td>25 stroke (nm, all aphasics), SLT referrals, 2.70 years</td>
<td>10/23 on ADRS, 12/24 on SADQ-10, 10/25 met threshold on both scales</td>
<td>Internal consistency - Very good Cronbach’s alpha 0.793, 0.828 with removal of question 10 [14]</td>
<td>Hypothesis testing - Adequate SADQ-10: Positive correlation with ADRS scores, (r=0.708, p&lt;0.001). Cronbach’s 0.793, removal of Q10 = 0.828. [14]</td>
<td>Internal consistency Hypothesis testing</td>
<td></td>
</tr>
<tr>
<td>SADQ-21</td>
<td>Sutcliffe et al, (1998). [29] UK</td>
<td>17 patients that could not complete standardised measures, (with carers) identified from Speech and language therapy registers, observer rated measure</td>
<td>Not specified by authors. Specifically looking for aphasic patients unable to complete measures, no detail of severity of injury or cognition.</td>
<td>N/A</td>
<td>None</td>
<td>• Reliability - Doubtful Spearman's Correlation r=0.72, p&lt;0.001 [27]</td>
<td>Reliability ?</td>
</tr>
</tbody>
</table>
| SADQ-H | Bennett et al, (2006). [30] UK | 100 stroke patients (nm), 2-4 weeks post stroke | Not specified by authors. HADS completed by those with “no communication impairment”. 79/100 completed HADS (79%) | Of the 79 patients, 16 were depressed (20%) and 17 (22%) anxious. | None | • Internal consistency - Very good (α=0.84) [26]  
• Hypothesis testing - Adequate Correlation with HADS-D rs=0.52, P=.<.001 (significant at 1% level) [26] | Internal consistency  Hypothesis testing + |
| SADQ H-10 | Cobley et al, (2011). [31] UK | 165 aphasia patients from stroke wards and community (nm). Majority in first 6 months of stroke. | Not specified by authors. Not clarified. Report getting assent from family for participants with severe aphasia. | 76/165 low mood (45%) | None | • Structural validity – Adequate 3 Eigenvalues accounted for 59.4% of variance (social interaction & physical pain, tearful, & loss of interest and motivation,) [25]  
• Internal consistency- Doubtful Cronbach's alpha=0.77, r=0.75. 3 [25]  
• Hypothesis testing – Doubtful Correlation with HADS-D r=0.53, P=.<.001 (significant at 1% level) [26] | Structural validity  Internal consistency Hypothesis testing ? |
| Bennett et al, (2006). [30] | 100 stroke patients (nm), 2-4 weeks post stroke | Not specified by authors. HADS completed by those with “no” | Of the 79 patients, 16 were depressed | None | • Internal consistency - Very good Low (α=0.68) [26]  
• Hypothesis testing - Adequate | Internal consistency  Hypothesis testing + |
<table>
<thead>
<tr>
<th>Country</th>
<th>Study</th>
<th>Sample Description</th>
<th>Communication Impairment</th>
<th>HADS (79%)</th>
<th>Correlation with VAMS - sad r=0.30, p&lt;0.001, Depression =r=0.06, p=0.59.[25]</th>
</tr>
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<tbody>
<tr>
<td>UK</td>
<td>SIMS</td>
<td>Gertler et al, (2020.) [32] AUS</td>
<td>61 TBI patients in the community (nm), 5.71 years post injury (mean)</td>
<td>PTA WHODAS divided into low (less impairment) and high group (more impairment), (high n=29)</td>
<td>20 were diagnosed with MDE via SCID (32.8%)</td>
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<td>• Reliability - Inadequate Repeated measures by time rs (p) SEM: SIMS verbal 61 (.00) 1.41; SIMS visual .70 (.00) 1.40. Z (p) Effect size: SIMS verbal –3.21 (.00).42; SIMS visual –3.38 (.00).44. [31]</td>
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<td>• Measurement error - Inadequate Repeated measures by time rs (p) SEM: SIMS verbal 61 (.00) 1.41; SIMS visual .70 (.00) 1.40. Z (p) Effect size: SIMS verbal –3.21 (.00).42; SIMS visual –3.38 (.00).44. [31]</td>
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<td>• Construct validity - Very good Correlation with MDE diagnostic status on the SCID-5 showed moderate point-biserial correlation coefficients with both SIMS-Verbal (r = −0.51, p &lt; .01) and SIMS Visual (r = −0.55, p &lt; .01) at Time 1. Visual. Time 1 (n = 61), Time 2 (n=58).</td>
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<td>• Hypothesis testing - Very good Difference between MDE and no MDE. Mann-Whitney U. SIMS verbal –3.84 (.00)/.49 (time 1); –3.89 (.00)/.50 (time 2). SIMS visual –4.26 (.00)/.55 (time 1) –4.25 (.00)/.54 (time 2).[31]</td>
</tr>
<tr>
<td>UK</td>
<td>SDSS</td>
<td>Lightbody et al, (2006). [33]</td>
<td>71 acute stroke patients in hospital (nm). Assessed by nurse and carer.</td>
<td>Not specified by authors. No exclusions, cognition measured by RBMT – 0-2=severe, 3-6=moderate</td>
<td>SCID 35.2%, Nurse SDSS 46.5%, Carer SDSS 22/30(73.3%)</td>
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<td>• Reliability - Doubtful Interrater ICC=0.43, 95% (CI:0.09-0.68) - moderate at best. [28]</td>
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<td>• Criterion validity - Very good Nurses SDSS cut off&gt;2 was: sensitivity &gt;2 = 64% (CI:43-82%), Specificity=61% (CI:45-75%),Efficiency (proportion correctly identified as positive or</td>
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<table>
<thead>
<tr>
<th>Author</th>
<th>Study Population</th>
<th>Cognitive Impairment</th>
<th>Cut-off and Sensitivity/Specificity/Efficiency</th>
<th>Internal Consistency</th>
<th>Reliability</th>
<th>Criterion Validity</th>
<th>Hypothesis Testing</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>van Dijk et al, (2017). [34] The Netherlands</td>
<td>116 patients (nm), of which 53 (45.7%) with communicative impairment</td>
<td>Not specified by authors. Patients with communicative impairment had a Barthel Index score of 5 (interquartile range (IQR) 9, range: 0–20))</td>
<td>CIDI= 35.8% (n=19) in patients with communicative impairment and 12.7% (n=8) in patients who were able to communicate</td>
<td>Clinical interview</td>
<td>-</td>
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<td>Internal consistency - Very good (α=0.57) [29]</td>
<td>Reliability - Doubtful inter-rater reliability of the SDSS (ICC=0.80; 95% CI: 0.63–0.89) [29]</td>
<td>Criterion validity - Very good The discriminatory power at a cut-off score of ≥2 sensitivity of 0.74 (95% CI: 0.49–0.91), a specificity of 0.40 (95% CI: 0.23–0.58), a PPV of 0.41 (95% CI: 0.25–0.59), an NPV of 0.72 (95% CI: 0.47–0.90), and an area under the curve (AUC) of 0.58 (95% CI: 0.42–0.75). [29]</td>
<td>Hypothesis testing - Adequate Correlation between the CIDI-relative and the SDSS (rs=0.18, P=0.30). Correlation between the Barthel Index and the SDSS (rs=−0.33, P=0.02) [29]</td>
</tr>
<tr>
<td>Bennett et al, (2006). [30] UK</td>
<td>100 stroke patients (nm)</td>
<td>Not specified by authors. HADS completed by those with “no communication impairment”. 79/100 completed HADS (79%)</td>
<td>Of the 79 patients, 16 were depressed (20%) and 17 (22%) anxious.</td>
<td>None</td>
<td>Internal consistency - Very good Low (α=0.53) [26]</td>
<td>Hypothesis testing - Adequate Correlation between SDSS and HADS-D rs=0.34, P=.004 (significant at 5% level) [26]</td>
<td>Internal consistency Hypothesis testing</td>
<td></td>
</tr>
<tr>
<td>SDSS-Likert</td>
<td>van Dijk et al, (2017).</td>
<td>116 patients, of which 53 (45.7%) with communicative impairment</td>
<td>Not specified by authors. Patients with CIDI= 35.8% (n=19) in patients with communicative impairment and 12.7% (n=8) in patients who were able to communicate</td>
<td>Clinical interview</td>
<td>Internal consistency - Very good SDSS-Likert s α=0.69 [29]</td>
<td>Internal consistency Reliability</td>
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</tr>
<tr>
<td>Reference</td>
<td>Country</td>
<td>Sample Description</td>
<td>Participant Characteristics</td>
<td>SDSS-Likert Characteristics</td>
<td>Reliability</td>
<td>Hypothesis Testing</td>
<td>Criterion Validity</td>
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<td>[29]</td>
<td>The Netherlands</td>
<td>Communicative impairment (n=53) had moderate to severe disability [median Barthel Index score of 5 (interquartile range (IQR) 9, range: 0–20)] Population mean MMSE 24.1 [SD=3.5, range=8-30]</td>
<td>Communicative impairment and 12.7% (n=8) in patients who were able to communicate</td>
<td>Moderate to severe disability [median Barthel Index score of 5 (interquartile range (IQR) 9, range: 0–20)]</td>
<td>Doubtful</td>
<td>Adequate</td>
<td>Very good</td>
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<tr>
<td>[29]</td>
<td>The Netherlands</td>
<td>Communicative impairment (n=53) had moderate to severe disability [median Barthel Index score of 5 (interquartile range (IQR) 9, range: 0–20)] Population mean MMSE 24.1 [SD=3.5, range=8-30]</td>
<td>Communicative impairment and 12.7% (n=8) in patients who were able to communicate</td>
<td>Moderate to severe disability [median Barthel Index score of 5 (interquartile range (IQR) 9, range: 0–20)]</td>
<td>Doubtful</td>
<td>Adequate</td>
<td>Very good</td>
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<tr>
<td>Cohen et al, (2018). [30] USA</td>
<td>TBI-QoL-D</td>
<td>381 TBI patients in rehabilitation hospitals (54.3% severe), variable time since injury, Not specified by authors. “Confirmed with medical records”.</td>
<td>None</td>
<td>None</td>
<td>Adequate</td>
<td>Correlated with TBI-QoL r=0.83, p;&lt;001. [30]</td>
<td>Hypothesis testing</td>
<td></td>
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<tr>
<td>[29]</td>
<td>The Netherlands</td>
<td>Communicative impairment (n=53) had moderate to severe disability [median Barthel Index score of 5 (interquartile range (IQR) 9, range: 0–20)] Population mean MMSE 24.1 [SD=3.5, range=8-30]</td>
<td>Communicative impairment and 12.7% (n=8) in patients who were able to communicate</td>
<td>Moderate to severe disability [median Barthel Index score of 5 (interquartile range (IQR) 9, range: 0–20)]</td>
<td>Doubtful</td>
<td>Adequate</td>
<td>Very good</td>
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<tr>
<td>Bennett et al, (2006). [30] UK</td>
<td>VAMS</td>
<td>100 stroke patients (nm), 2-4 weeks post stroke, Not specified by authors. HADS completed by those with “no communication impairment”. 79/100 completed HADS (79%)</td>
<td>Of the 79 patients, 16 were depressed (20%) and 17 (22%) anxious.</td>
<td>None</td>
<td>Very good</td>
<td>Correlation with HADS-D rs=0.36, P &lt;.001 (significant at 1% level) [26]</td>
<td>Internal consistency</td>
<td></td>
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<tr>
<td>Benaim et al, (2010). [16]</td>
<td>49 stroke (nm, 23 Aphasic), Rehabilitation centre, 66+39</td>
<td>Not specified by authors. Answers of 18% considered</td>
<td>43% depressed according to Psychologist.</td>
<td>Psychologist interview</td>
<td>Doubtful</td>
<td>D0:r=0.71, P&lt;10-6, D30: r=0.52, P&gt;10-3) [13]</td>
<td>Responsiveness</td>
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<tr>
<td>Country</td>
<td>Study Design</td>
<td>Sample Size</td>
<td>Description</td>
<td>Reliability</td>
<td>Hypothesis Testing</td>
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<td>France</td>
<td>Kinsella et al, 1988. [23]</td>
<td>39 rehabilitation patients (n=39), within 2 years of ABI</td>
<td>&gt;24 hours PTA, (29 &gt;4 weeks PTA). 11 inpatients, 8 completed rehab, 20 outpatients.</td>
<td>Reliability - Doubtful Re-test of n=20, r=0.67-0.92 [23]</td>
<td>Hypothesis testing - Doubtful Correlated with observer completion of scale, r=0.217, p=0.217 [23]</td>
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<tr>
<td>Australia</td>
<td>Bennett et al, 2006. [26]</td>
<td>100 stroke patients (nm), 2-4 weeks post stroke</td>
<td>Not specified by authors. HADS completed by those with “no communication impairment”. 79/100 completed HADS (79%)</td>
<td>Internal consistency - Very good Low (α=0.83) [26]</td>
<td>Hypothesis testing - Adequate Correlation with HADS-D rs= -0.52, &lt;0.001 (significant at 1% level) [26]</td>
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+: sufficient, -: insufficient, ?: indeterminate.

ABI=Acquired brain injury, ADRS=Aphasia Depression rating scale, BDI=Beck Depression inventory, CES-D=Centre for epidemiologic studies depression scale, CGI-S=Clinical Global Impression rating scale for severity, CIDI-Composite international diagnostic interview, DASS-21=Depression anxiety stress scales, DISCs=Depression Intensity Scale Circles, DSM-IV=Diagnostic and Statistical Manual for Mental Disorders IV, FIM=FAM= Functional independence measure + Functional Assessment Measure, GCS=Glasgow Coma Scale, GHQ=General Health Questionnaire, HADS=Hospital anxiety and depression scale, HAM-D=Hamilton depression rating scale, ICD-10=International classification of diseases, Leeds=Leeds scale for depression & anxiety, MADRS=Montgomery-Asberg Depression rating scale, Nm= not mentioned, PCD=psychiatrist clinical diagnosis, PHQ=Patient Hospital Questionnaire, PTA=post-traumatic amnesia, RBMT=Rivermead Behavioural memory test, SADQ=Stroke Aphasic Depression Questionnaire, SADQ-H=Stroke Aphasic Depression Questionnaire Hospital version, SCID=Structured clinical interview for DSM, SDSS=Signs of Depression scale, SIMS=Single Item Mood Scale, SLT=Speech and language therapist, TBI=Traumatic brain injury, TBI QoL-D=Traumatic Brain injury quality of life scale, VAMS=Visual analogue mood scale, VAS-D=Visual analogue scale for depression, VASES=Visual analogue of self-esteem scale.
Table 2: Description of the mood assessment measures included in this review

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<th>Measure</th>
<th>Abbreviation</th>
<th>Construct</th>
<th>Target population</th>
<th>Details</th>
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<th>Administration time</th>
<th>Training</th>
<th>Rater</th>
<th>Cut Off</th>
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<tbody>
<tr>
<td>1. Aphasic depression rating scale</td>
<td>ADRS</td>
<td>Depression</td>
<td>Stroke</td>
<td>9 item external assessment</td>
<td>Freely available (internet)</td>
<td>NM</td>
<td>NM</td>
<td>Clinician</td>
<td>19/32</td>
</tr>
<tr>
<td>2. Beck depression inventory</td>
<td>BDI</td>
<td>Depression</td>
<td>General Population</td>
<td>21 items, self-report</td>
<td>Meant to purchase, is freely available</td>
<td>10 minutes</td>
<td>Not required*</td>
<td>Patient</td>
<td>0-10 absent or minimal depression; 10-18 mild to moderate depression; 19-29 is moderate depression; 30-63 is severe depression.</td>
</tr>
<tr>
<td>3. Beck depression inventory-II</td>
<td>BDI-II</td>
<td>Depression</td>
<td>General Population</td>
<td>21 items, self-report</td>
<td>Meant to purchase, is freely available</td>
<td>10 minutes</td>
<td>Not required*</td>
<td>Patient</td>
<td>0-13 none or minimal depression 14-19 mild depression; 20-28 moderate depression; 29-63 severe depression.</td>
</tr>
<tr>
<td>4. Centre for epidemiologic studies depression scale</td>
<td>CES-D</td>
<td>Depression</td>
<td>General population</td>
<td>20 item self-rated, 4 point scale</td>
<td>Freely available (internet)</td>
<td>10-20 minutes</td>
<td>None</td>
<td>Patient</td>
<td>&gt;16 depression (higher scores = more symptomology)</td>
</tr>
<tr>
<td>5. Clinical Global Impression rating scale for severity</td>
<td>CGI-S</td>
<td>Mental illness</td>
<td>Psychiatric population</td>
<td>3 item observer rated; Clinician rated on 7 point scale</td>
<td>Freely available</td>
<td>Varies</td>
<td>NM</td>
<td>clinician</td>
<td>Between 1 and 2</td>
</tr>
<tr>
<td>7. Depression Intensity Scale Circles</td>
<td>DISCs</td>
<td>Depression</td>
<td>Acquired brain injury</td>
<td>Graphic scale with 6 circles with increasing proportion of dark shading, self-rated</td>
<td>Freely available</td>
<td>Less than 5 minutes</td>
<td>NM</td>
<td>Patient supported by clinician</td>
<td>&gt;/= 2 indicates &quot;caseness&quot;</td>
</tr>
<tr>
<td>8. General Health Questionnaire</td>
<td>GHQ</td>
<td>Mental health</td>
<td>General population</td>
<td>30 item self-report</td>
<td>Available for purchase</td>
<td>Approx. 5 minutes</td>
<td>NM</td>
<td>Patient</td>
<td>4 and above indicates &quot;caseness&quot;</td>
</tr>
<tr>
<td>9. Geriatric Mental Status Schedule</td>
<td>GMSS</td>
<td>Geriatric mental health</td>
<td>Geriatric general population</td>
<td>Structured interview for psychopathology</td>
<td>Available for purchase</td>
<td>45 minutes</td>
<td>Required</td>
<td>Clinician interview self-report</td>
<td>Various interpretations related to specific diagnoses.</td>
</tr>
<tr>
<td>10. Hospital anxiety and depression scale</td>
<td>HADS</td>
<td>Anxiety &amp; Depression</td>
<td>General medical population</td>
<td>14 scale item, 7 depression items, self-rated</td>
<td>Freely available (internet), recently need to purchase</td>
<td>2-5 minutes</td>
<td>Not required*</td>
<td>Patient</td>
<td>&gt;11 indicates &quot;caseness&quot;</td>
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<tr>
<td>11. Hamilton depression rating scale</td>
<td>HAM-D</td>
<td>Depression</td>
<td>General Population</td>
<td>21 items, scored out of 17 items, clinician rated</td>
<td>Freely available</td>
<td>15-20 minutes</td>
<td>Not required*</td>
<td>Clinician 0-7 normal, 8-13 mild, 14-18 moderate, 19-22 severe, &gt;23 very severe</td>
<td></td>
</tr>
<tr>
<td>12. Leeds scale for depression &amp; anxiety</td>
<td>LEEDS</td>
<td>Depression</td>
<td>General population</td>
<td>15 item self-report</td>
<td>Unable to locate scale. Discontinued.</td>
<td>NM</td>
<td>NM</td>
<td>Patient 6 or 7 as cut off</td>
<td></td>
</tr>
<tr>
<td>13. Montgomery-Asberg Depression rating scale</td>
<td>MADRS</td>
<td>Depression</td>
<td>General population</td>
<td>10 items, interviewer administered</td>
<td>Freely available</td>
<td>20-60 minutes</td>
<td>None required</td>
<td>Clinician 7-19 mild, 20-34 moderate, 35-60 severe depression</td>
<td></td>
</tr>
<tr>
<td>14. Patient Hospital Questionnaire</td>
<td>PHQ 9</td>
<td>Depression</td>
<td>General medical population</td>
<td>9 item self-rated</td>
<td>Freely available (internet)</td>
<td>NM</td>
<td>Not required*</td>
<td>Patient 1-4 Minimal depression, 5-9 Mild depression, 10-14 Moderate depression, 15-19 Moderately severe depression, 20-27 Severe depression</td>
<td></td>
</tr>
<tr>
<td>15. Stroke Aphasic Depression Questionnaire</td>
<td>SADQ-21</td>
<td>Depression</td>
<td>Stroke patients with aphasia (community)</td>
<td>21 item observer rated</td>
<td>Freely available (internet)</td>
<td>4 minutes</td>
<td>Not required*</td>
<td>Clinician/observer</td>
<td></td>
</tr>
<tr>
<td>16. Stroke Aphasic Depression Questionnaire (10 item)</td>
<td>SADQ-10</td>
<td>Depression</td>
<td>Stroke patients with aphasia</td>
<td>10 item observer rated</td>
<td>Freely available (internet)</td>
<td>2 minutes</td>
<td>Not required*</td>
<td>Clinician/Observer</td>
<td></td>
</tr>
<tr>
<td>17. Stroke Aphasic Depression Questionnaire Hospital version</td>
<td>SADQH</td>
<td>Depression</td>
<td>Stroke patients with aphasia</td>
<td>21 item observer rated</td>
<td>Freely available (internet)</td>
<td>4 minutes</td>
<td>Not required*</td>
<td>Clinician/Observer</td>
<td></td>
</tr>
<tr>
<td>18. Stroke Aphasic Depression Questionnaire Hospital version (10 item)</td>
<td>SADQH-10</td>
<td>Depression</td>
<td>Stroke patients with aphasia</td>
<td>10 item observer rated</td>
<td>Freely available (internet)</td>
<td>2 minutes</td>
<td>Not required*</td>
<td>Clinician/Observer</td>
<td></td>
</tr>
<tr>
<td>19. Single Item Mood Scale</td>
<td>SIMS</td>
<td>Mood state</td>
<td>Traumatic brain injury patients</td>
<td>Emotion faces and numerical rating</td>
<td>Freely available (internet)</td>
<td>&lt;5 minutes</td>
<td>Not required</td>
<td>Patient Rates mood on scale of 1-10, measure change over time</td>
<td></td>
</tr>
<tr>
<td>20. Signs of Depression scale</td>
<td>SDSS</td>
<td>Depression</td>
<td>Elderly medically ill patients</td>
<td>6 item observer rated</td>
<td>Freely available</td>
<td>&lt;2 minutes</td>
<td>None required</td>
<td>Observer &gt;2 = probable depression</td>
<td></td>
</tr>
<tr>
<td>21. Signs of Depression scale – Likert</td>
<td>SDSS- Likert</td>
<td>Depression</td>
<td>Elderly medically ill patients</td>
<td>6 item observer rated</td>
<td>Freely available</td>
<td>&lt;2 minutes</td>
<td>None required</td>
<td>Observer &gt;2 = probable depression</td>
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<tr>
<td>22. Traumatic Brain injury quality of life scale</td>
<td>TBI-QOL</td>
<td>Quality of life</td>
<td>Traumatic brain injury separate scale</td>
<td>Not freely available</td>
<td>NM</td>
<td>NM</td>
<td>Patient</td>
<td>NM</td>
<td></td>
</tr>
<tr>
<td>25. Visual analogue of self-esteem scale</td>
<td>VASES</td>
<td>Mood and self esteem</td>
<td>Stroke patients</td>
<td>10-item visual analogue scale</td>
<td>Available for purchase</td>
<td>NM</td>
<td>Manual purchased</td>
<td>Patient</td>
<td>NM</td>
</tr>
</tbody>
</table>

NM= Not mentioned, *Instructions provided for administration on the measure.
Figure 1. PRISMA flow chart showing numbers through article selection process [8]

**Identification of studies via databases and registers 2020**
- Records identified from Databases (n = 20,606)
  - (EbscoHost n = 9,867)
  - (WoS n = 8,094) (Ovid n = 1,057) (Cochrane n = 1,588)
- Records removed before screening: Duplicate records removed via Endnote (n = 5,256)
- Records excluded:
  - Not ABI specific (n = 7,841)
  - Not clinical assessment/not specifically mood disorder related (e.g. QoL, Suicide, PTSD) (n = 6,168)
- Records title screened (n = 15,350)
- Records abstract and method screened (n = 1,341)
- Records abstract and method screened (n = 670)
- Records excluded: Records excluded if mild ABI or if mood not primary outcome (n = 671)
- Records excluded: Not validation study (n = 427)
  - Method described populations as mild/moderate (n = 171)
- Reports assessed for eligibility (n = 72)
- Studies included in review (n = 19)

**Identification of studies via other methods**
- Records identified from:
  - Citation searching (n = 109)
  - (EbscoHost n = 729)
  - (WoS n = 548) (Ovid n = 531) (Cochrane n = 36)
- Records abstract and method screened (n = 27)
- Reports assessed for eligibility (n = 3)
- Studies included in review (n = 0)

**Identification of studies at repeat searches 2021,2022**
- Records identified from:
  - Databases (n = 1,844) title screened
  - (EbscoHost n = 729)
  - (WoS n = 548) (Ovid n = 531) (Cochrane n = 36)
- Records abstract and method screened (n = 27)
- Reports assessed for eligibility (n = 3)
- Studies included in review (n = 0)
- Reports excluded:
  - Participants excluded if unable to complete measures (n = 68)
  - Cognitive assessment result indicates severe participants excluded (n = 5)
  - Results show Less than 50% severe (n = 11)
  - Mood not main outcome (n = 6)
  - Not validation study (n = 9)

ABI = Acquired brain injury, PTSD = Post-traumatic stress disorder, QoL = Quality of life.
Rose, et al. (2022) A systematic review of mood and depression measures in people with severe cognitive and communication impairments following acquired brain injury.

Appendix II: Search terms

Cochrane Library: Cochrane Database for Systematic Reviews (CDSR) & Cochrane Central Register of Controlled Trials (CENTRAL)

Last search run: 01.09.2022

S1 = “brain injury” or “acquired brain injury” or “traumatic brain injury” or “head injury” or “diffuse axonal injury” or “brain hypoxia” (TS) OR Stroke or “cerebrovascular accident” (TS)

S2 = Mood or depress* or emotion* or affect* or “psychological distress” or “emotional distress” (TS) AND Assess* or screen* or measur* or evaluat* or rating or “assessment scale” (TS)

S3 = S1 AND S2

Web of science: Core collection & MEDLINE databases

Last search run: 01.09.2022

S1 = “brain injury” or “acquired brain injury” or “traumatic brain injury” or “head injury” or “diffuse axonal injury” or “brain hypoxia” (TS) OR Stroke or “cerebrovascular accident” (TS)

S2 = Mood or depress* or emotion* or affect* or “psychological distress” or “emotional distress” (TS) AND Assess* or screen* or measur* or evaluat* or rating or “assessment scale” (TS)

S3 = S1 AND S2

S4 = S3 NOT Animal or mouse or mice or rodent or veterinary
Rose, et al. (2022) A systematic review of mood and depression measures in people with severe cognitive and communication impairments following acquired brain injury.

S5 = S4 NOT TS= (paediatric OR adolescent OR child OR infant)

S6 = S5 NOT TS= (Animal or veterinary or mouse or mice or rodent)

**Ovid: Health and Psychosocial Instruments & Embase databases**

Last search run: 01.09.2022

S1 = TS = (Brain injury or head injury or traumatic brain injury or acquired brain injury or diffuse axonal head injury or brain hypoxia or TBI or ABI or DAI)

Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=All years

S2 = TS= (Mood or emotion or feeling* or sad* or depress* or emotional distress)

Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=All years

S3 = TS= (Assess* or measur* or evaluat* or scale or inventory or questionnaire or instrument or screen* or rating)

Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=All years

S4 = AB= (Brain injury or head injury or traumatic brain injury or acquired brain injury or diffuse axonal head injury or brain hypoxia or TBI or ABI or DAI)

Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=All years

S5 = AB= (Mood or emotion or feeling* or sad* or depress* or emotional distress)
Rose, et al. (2022) A systematic review of mood and depression measures in people with severe cognitive and communication impairments following acquired brain injury.

Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=All years

S6 = AB= (Assess* or measur* or evaluat*or scale or inventory or questionnaire or instrument or screen* or rating)

Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=All years

S7 = #4 OR #1

Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=All years

S8 = #5 OR #2

Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=All years

S9 = #6 OR #3

Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=All years

S10 = #9 AND #8 AND #7

Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=All years

S11 = All= (Brain injury or head injury or traumatic brain injury or acquired brain injury or diffuse axonal head injury or brain hypoxia or TBI or ABI or DAI)

Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=All years
Rose, et al. (2022) A systematic review of mood and depression measures in people with severe cognitive and communication impairments following acquired brain injury.

S12 = TI = (Brain injury or head injury or traumatic brain injury or acquired brain injury or diffuse axonal head injury or brain hypoxia or TBI or ABI or DAI)

Indexes = SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan = All years

S13 = #12 OR #11 OR #4 OR #1

Indexes = SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan = All years

S14 = ALL = (Mood or emotion or feeling* or sad* or depress* or emotional distress)

Indexes = SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan = All years

S15 = TI = (Mood or emotion or feeling* or sad* or depress* or emotional distress)

Indexes = SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan = All years

S16 = #15 OR #14 OR #5 OR #2

Indexes = SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan = All years

S17 = ALL = (Assess* or measur* or evaluat* or scale or inventory or questionnaire or instrument or screen* or rating)

Indexes = SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan = All years

S18 = TI = (Assess* or measur* or evaluat* or scale or inventory or questionnaire or instrument or screen* or rating)
Rose, et al. (2022) A systematic review of mood and depression measures in people with severe cognitive and communication impairments following acquired brain injury.

Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=All years

S19 = #18 OR #17 OR #6 OR #3

Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=All years

S20 = #19 AND #16 AND #13

Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=All years

**EBSCOHost: CINAHL, PsyArticles, PsycInfo & Psychology and behavioral sciences database**

- **CINAHL**

  Last search run: 01.09.2022

S12 S3 AND S6 AND S9 Expanders - Apply equivalent subjects

Narrow by SubjectMajor: - stroke patients

Narrow by SubjectMajor: - brain injuries

Narrow by SubjectMajor: - depression

Narrow by SubjectMajor: - stroke

Narrow by SubjectAge: - all adult

S11 S3 AND S6 AND S9 Expanders - Apply equivalent subjects

Narrow by SubjectAge: - all adult
Rose, et al. (2022) A systematic review of mood and depression measures in people with severe
cognitive and communication impairments following acquired brain injury.

S10  S3 AND S6 AND S9    Expanders - Apply equivalent subjects

S9  S7 OR S8    Expanders - Apply equivalent subjects

S8  AB (Assess* or measur* or evaluat*) OR AB (scale or inventory or questionnaire or
instrument or screen* or rating)    Expanders - Apply equivalent subjects

S7  TX (Assess* or measur* or evaluat*) OR TX (scale or inventory or questionnaire or
instrument or screen* or rating)    Expanders - Apply equivalent subjects

S6  S4 OR S5    Expanders - Apply equivalent subjects

S5  AB (Mood or emotion or feeling* or sad*) OR AB (depress*) OR AB (emotional
distress)    Expanders - Apply equivalent subjects

S4  TX (Mood or emotion or feeling* or sad*) OR TX (depress*) OR TX (emotional
distress)    Expanders - Apply equivalent subjects

S3  S1 OR S2    Expanders - Apply equivalent subjects

S2  AB (Brain injury or head injury or traumatic brain injury or acquired brain injury or
diffuse axonal head injury or brain hypoxia or TBI or ABI or DAI) OR AB (stroke or
cerebrovascular accident or CVA)    Expanders - Apply equivalent subjects

S1  TX (Brain injury or head injury or traumatic brain injury or acquired brain injury or
diffuse axonal head injury or brain hypoxia or TBI or ABI or DAI) OR TX (stroke or
cerebrovascular accident or CVA)    Expanders - Apply equivalent subjects

- APA PsycArticles, APA Psynfo & Psychology and behavioural sciences database

Last search run: 01.09.2022
Rose, et al. (2022) A systematic review of mood and depression measures in people with severe cognitive and communication impairments following acquired brain injury.

Advanced Search Boolean/Phrase Interface

S23 S22 NOT SU (dementia or Alzheimer’s) - Boolean/Phrase Interface

S22 S21 NOT SU (animal or mouse or mice or rodent or veterinary)

S21 S20 NOT SU (paediatric or pediatric or child* or infant or adolescent)

S20 S9 AND S14 AND S19

S19 S15 OR S16 OR S17 OR S18

S18 SU Assess* or screen*

S17 TX Assess* or screen*

S16 SU Assessment Expander - Apply equivalent subjects

S15 TX Assessment

S14 S10 OR S11 OR S12 OR S13

S13 SU Mood or depress* or emotion* or “psychological distress” or “emotional distress” Expander - Apply equivalent subjects

S12 TX Mood or depress* or emotion* or “psychological distress” or “emotional distress” Expander - Apply equivalent subjects

S11 SU mood

S10 TX mood

S9 S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8

S8 SU Stroke or “cerebrovascular accident”
Rose, et al. (2022) A systematic review of mood and depression measures in people with severe cognitive and communication impairments following acquired brain injury.

S7 TX Stroke or “cerebrovascular accident”

S6 SU stroke

S5 TX stroke

S4 SU “brain injury” or “acquired brain injury” or “traumatic brain injury” or “head injury”

S3 TX “brain injury” or “acquired brain injury” or “traumatic brain injury” or “head injury”

S2 SU "brain injury"

S1 TX "brain injury" Expanders - Apply equivalent subjects