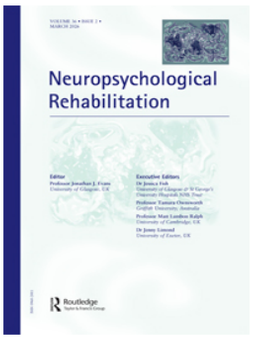

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REVIEW ARTICLE

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Examining the utilisation and validity of the Depression Intensity Scale Circles (DISCs): A scoping review

Olivia De Gruchy[a], Catherine E. L. Ford [b] and Ian Kneebone[a]

[a]Discipline of Clinical Psychology, Faculty of Health, University of Technology, Ultimo, Australia; [b]Department of Clinical Psychology and Psychological Therapies, Norwich Medical School, Faculty of Medicine and Health Sciences, University of East Anglia, Norwich, UK

ABSTRACT

The Depression Intensity Scale Circles (DISCs) is a visual self-report depression screening tool that has been designed specifically for people with moderate-to-severe cognitive or communicative impairment. This scoping review aimed to systematically map research on the DISCs, drawing conclusions about its reliability, validity, and utilization in research and clinical practice. A literature search from 2004 – July 2024 was conducted using 9 databases. Thirty-six sources met inclusion criteria of mentioning "Depression Intensity Scale Circles" in their abstract or full text (15 published literature, 12 grey literature, and 9 social media posts). Only three sources formally studied the psychometric properties of the DISCs. Taken together, their results suggested that the DISCs has stronger predictive validity than reported in previous systematic reviews. While promising, these results should be interpreted cautiously due to the limited research available. Despite limited research, we found that the DISCs continues to be recommended and included into guidelines for depression screening, especially in in-patient stroke settings in the UK. The need for further research into the psychometric properties of the DISCs is identified. The trade-off in clinical settings between psychometric validity and clinical utility when working with individuals with cognitive and communication impairments is highlighted.

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Mood screening; Depression; Cognitive impairment; Rehabilitation; Communication

Introduction

Cognitive impairment is a globally prevalent concern, impacting people aged 60 years and older at a rate of 20% worldwide (Pais et al., 2020). Common causes of cognitive impairment include stroke, traumatic brain injury (TBI) and neurodegenerative diseases such as dementia, Parkinson's Disease and Huntington's

CONTACT Ian Kneebone ian.kneebone@uts.edu.au Discipline of Clinical Psychology, Faculty of Health, University of Technology, PO Box 123, Ultimo NSW 2007, Australia

Disease (Douglas & Bigby, 2020; Grzegorski & Losy, 2017; Lo Coco et al., 2016; Pérez Palmer et al., 2022). Cognitive impairment presents an important public mental health concern due to the significant impact it can have on mood.

Rates of depression in people with cognitive impairment have been found to be significantly higher than in the general population. While the rate of depression in the general population is estimated to be 5% worldwide (World Health Organisation, 2023), research has shown that the prevalence of depression in people with TBI, dementia, adult-onset Huntington's disease, Parkinson's disease, and stroke ranges from 31% to 77% (Clark et al., 2023; Cong et al., 2022; Hackett et al., 2005; Hackett & Pickles, 2014; Scholten et al., 2016; Steinberg et al., 2008). This positions these populations as primary candidates for routine screening for depression.

Screening for depression is important as depression can have a significant impact on the health and wellbeing of individuals with cognitive impairment if left untreated. Depression is linked to higher mortality rates in stroke survivors (Ayerbe et al., 2014), poorer quality of life in individuals with moderate-to-severe TBI (Grauwmeijer et al., 2018), and reduced functioning in daily activities of living in people with Parkinson's disease beyond the expected difficulties associated with the disease (Pontone et al., 2016). Early onset of depression is also strongly predictive of suicidal behaviour in Huntington's disease (Paoli et al., 2017), while stroke survivors demonstrate a 73% higher risk of suicide than non-stroke controls (Vyas et al., 2021).

The risk of developing depression is increased for people with moderate-to-severe cognitive impairment from neurological diseases or injuries. The Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-V; American Psychiatric Association, 2022) classifies someone with moderate cognitive impairment as having difficulty with basic tasks such as eating or personal hygiene, while severe cognitive impairment is classified as complete dependence on others (American Psychiatric Association, 2022). For stroke survivors, stroke severity and related cognitive impairment are positively correlated with risk of developing depression (Guo et al., 2022; Hackett & Anderson, 2005; Winstein et al., 2016). A systematic review found that more severe TBI is associated with higher risk of depression (Scholten et al., 2016). This makes people with moderate-to-severe cognitive impairment some of the most at-risk for depression and the negative associated life outcomes described above.

Recognition and treatment of depression is significantly lower in people with cognitive impairment than in the general adult population (Kok & Reynolds, 2017; Ronchetto & Ronchetto, 2022; Sirey et al., 2005; Volicer et al., 2011). This may reflect a lack of appropriate screening tools for depression in these populations. Some measures have been designed to attempt to address this issue. The Patient Health Questionnaire (9 items; PHQ-9; Kroenke et al., 2001) was developed to alleviate some of the difficulties in administering long, complex assessments in primary healthcare settings (Swartz et al., 2016). However, the

PHQ-9 uses questions about somatic symptoms of depression, which can easily be conflated with the somatic symptoms of disorders such as TBI (Cohen et al., 2018; Rose et al., 2023). To address this issue, other measures such as the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) and the Geriatric Depression Scale (GDS; Yesavage & Sheikh, 1986) are often used, as they do not contain questions about somatic symptoms (Stern, 2014). The GDS additionally aims to address the differences in depressive symptoms in older people, making it a helpful tool for assessing for depression in dementia (Dementia Australia, 2023). Unfortunately, these verbal self-report tools continue to exclude people with moderate-to-severe cognitive impairment and significant communication difficulties. Verbal self-report measures can be difficult to administer to people with aphasia, memory impairment or difficulty processing and understanding large amounts of verbal information. Studies on the validity and reliability of these measures also often exclude people with severe cognitive and communicative difficulties (Burton & Tyson, 2015; Rose et al., 2023), meaning that the research into the validity of verbal self-report measures in populations with moderate-to-severe cognitive impairment is very limited.

Self-report screening tools with visual aids may offer a more simplified method of depression screening for people with moderate-to-severe cognitive impairment. Visual self-report tools are often used in Intensive Care Units in hospitals as a valid measure of pain in people unable to communicate verbally (e.g., the Numeric Rating Scale with visual support (NRS-V) presented in Figure 1; Chanques et al., 2010). The Depression Intensity Scale Circles (DISCs; Turner-Stokes et al., 2005) is a visual depression self-report screening tool inspired by the NRS-V that has been specifically designed for people who have cognitive or communication difficulties due to an acquired brain injury. It does not require a verbal response and uses a visual aid to support comprehension of the assessment question (see Figure 2). The visual aid shows five circles placed in a vertical line, with the bottom circle completely white, and the top circle completely grey. The middle circles are shaded in increasing amounts of grey. The individual is asked the question, "*Which of these circles shows how depressed you feel today?*" They are then prompted to respond by choosing from the five circles, with the greyer circles indicating more depressed or sad feelings.

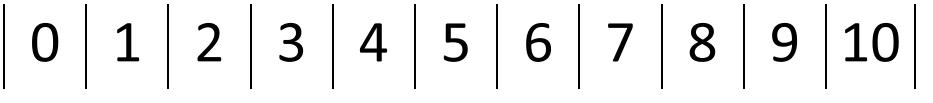

Figure 1. Numeric Rating Scale with Visual Support. Note. The Numeric Rating Scale with visual support (NRS-V) is used in hospital Intensive Care Units for patients with difficult communicating. Patients are asked to rate their pain on a scale from 0-10, where "0" is no pain and "10" is extreme pain. The visual support shown is provided to patients so that they can point to the number that corresponds with their pain, allowing it to be a non-verbal self-report measure.

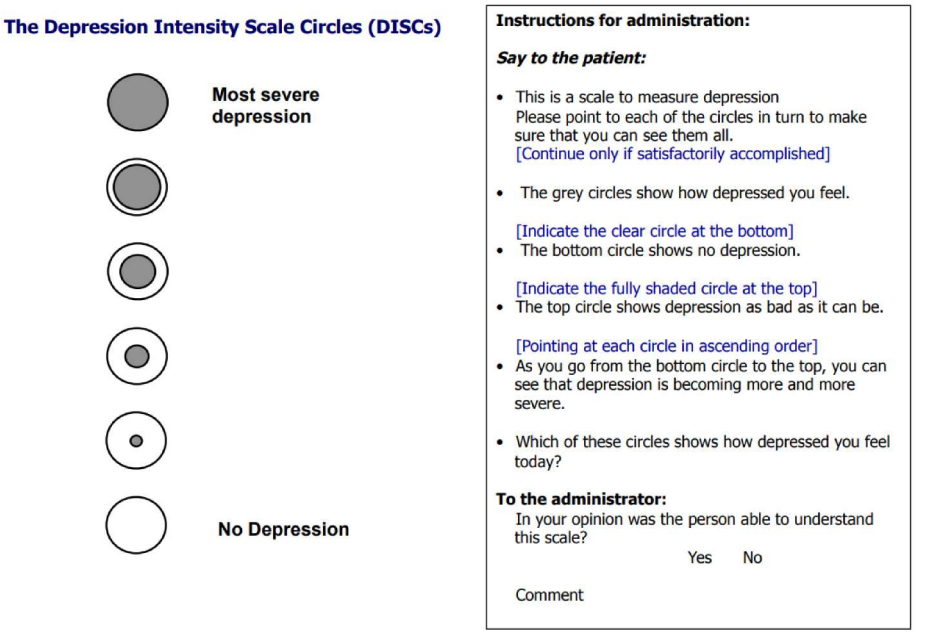

Figure 2. Depression Intensity Scale circles with administration instructions.

It is currently unclear how the DISCs is utilized in research and clinical practice. This includes information about the populations and settings in which the DISCs has been used. These are important because while the DISCs is recommended for use in populations with complex cognitive and communicative needs (Turner-Stokes et al., 2005), the reliability and validity of the DISCs has been assessed as poor in two systematic reviews (Burton & Tyson, 2015; Rose et al., 2023). However, these reviews only based their assessment on Turner-Stokes et al.'s (2005) original paper. It is therefore appropriate to revisit these findings and review whether more recent studies can shed further light on the reliability and validity of the DISCs.

The aim of this scoping review was to explore and systematically map research utilizing the DISCs, drawing conclusions about its reliability and validity and how the DISCs is utilized in research and clinical practice.

Methodology

This review and synthesis were conducted using guidance from the JBI Manual for Evidence Synthesis (Aromataris et al., 2024). A protocol was prepared and submitted to PROSPERO on 19-January 2024 and revised on 5-September 2024. The revision was required due to a change from a systematic review to a scoping review to best answer the proposed research question. Due to the research then falling outside of the PROSPERO guidelines (protocols for scoping reviews are not hosted), a new registration was made with Open

Science Framework (24-September 2024). The PROSPERO protocol can be found in Supplement 1 and the Open Science Framework protocol can be found at https://osf.io/t2m8x. The PRISMA revised statement for Scoping Reviews (PRISMA-ScR; Tricco et al., 2018) and the 2020 updated PRISMA statement (Page et al., 2021) were used to guide reporting. The PRISMA-ScR checklist can be found in Supplement 2.

Eligibility criteria

To be included in the review, sources had to mention the "Depression Intensity Scale Circles" within the abstract or full text of the article or source. Sources had to be published between 2004-2024, as the original validation article about the DISCs was published in 2005 (Turner-Stokes et al., 2005). Sources had to be published in English to be included. No exclusion criteria were included for the age of participants or cause of cognitive impairment.

Search strategy

To identify potentially relevant sources, the following electronic databases were searched from 2004 to July 2024: Medline Ovid, EmBase, PsycInfo, Web of Science and The Cochrane Database of Systematic Reviews. Grey literature was searched using the following electronic databases: Overton Bibliometric Database, ProQuest Dissertations and Theses, NewsBank and Altmetric. The search strategy was drafted and piloted by the author and an experienced academic librarian and reviewed by a senior academic (IK). Databases that searched the full text of sources required only one search term of "Depression Intensity Scale Circles". However, piloting of the search term "Depression Intensity Scale Circles" revealed that a significant number of already known sources were being missed in databases with abstract-only search functions, as the DISCs was often not mentioned in the abstract of sources. Databases that searched only the abstract required more broad search terms such as "mood screen*" or "depression screen*", with further search terms and MeSH terms included to capture populations with cognitive impairment or communication difficulties. The full search strategies for all databases are included in Appendix A. The search was supplemented by hand searching the references of included articles. The results of the literature search were imported into Covidence (Veritas Health Innovation, 2024), which was used for screening by the review team.

Screening and selection

As noted above, the search strategy was altered for some databases to more broadly capture sources that used mood or depression screening in populations

with cognitive or communicative impairment. Screening at the title and abstract level was subsequently modified to also include any source that referenced mood or depression screening but did not specifically state which screening tool was used. The full text level was then used to identify which sources met the original eligibility criteria of mentioning "Depression Intensity Scale Circles" or "DISCs" in the full text.

Two reviewers independently reviewed titles and abstracts, and then full-text articles, for inclusion. A calibration exercise was not used, however the reviewers discussed inconsistencies in screening after approximately 30 sources had been reviewed in the title/abstract screening stage, and again during the full text screening stage. Conflicts were resolved through discussion. While a third reviewer was available for any conflicts that were not able to be resolved through discussion, this was not necessary.

Data extraction

The data extraction form was developed by the author and assessed by a senior academic (IK). The author trialled the data extraction form with 10 sources, updating it as required. The two reviewers then independently charted the data, discussed the results and updated the data extraction form on one occasion to simplify reporting the age of participants and to include a question regarding the cut-off score for the DISCs identified in the source. Differences in data extraction were resolved by discussion between the two reviewers. The data extracted were: citation information, information about how the DISCs was utilized in the study, participant characteristics, study setting, inclusion and exclusion criteria, what the DISCs was used to measure and the cut-off point used, any modifications made to the DISCs, the number of studies included about the DISCs (if a systematic review), and any specific recommendations about population, administration, psychometric properties or setting for the DISCs. The final data extraction form can be found in Appendix B. Risk of bias of individual studies was not assessed because the aim of the review was to map the available evidence about the DISCs, as is consistent with scoping review methodology (Peters et al., 2015).

Synthesis of results

Content analysis of source characteristics was conducted and is presented below in a narrative synthesis. Sources were grouped by year of publication, source type, the setting and the population in which the DISCs was utilized. Conclusions about the psychometric properties of the DISCs and recommendations about settings, populations and administration of the DISCs were also included.

Results

A PRISMA flowchart is provided in Figure 3. A total of 1356 sources were identified, with 561 duplicates removed. 798 sources were reviewed at the title and abstract level, with 306 full-text sources then assessed for eligibility. Subsequently, 36 sources fulfilled the eligibility criteria and were included in this review. The main reason for exclusion at the full-text level was that the DISCs was not mentioned within the full text or abstract of the source (n = 246). Sources were also excluded because they were not published in English (n = 6), the same findings were repeated across multiple sources (n = 2), or the

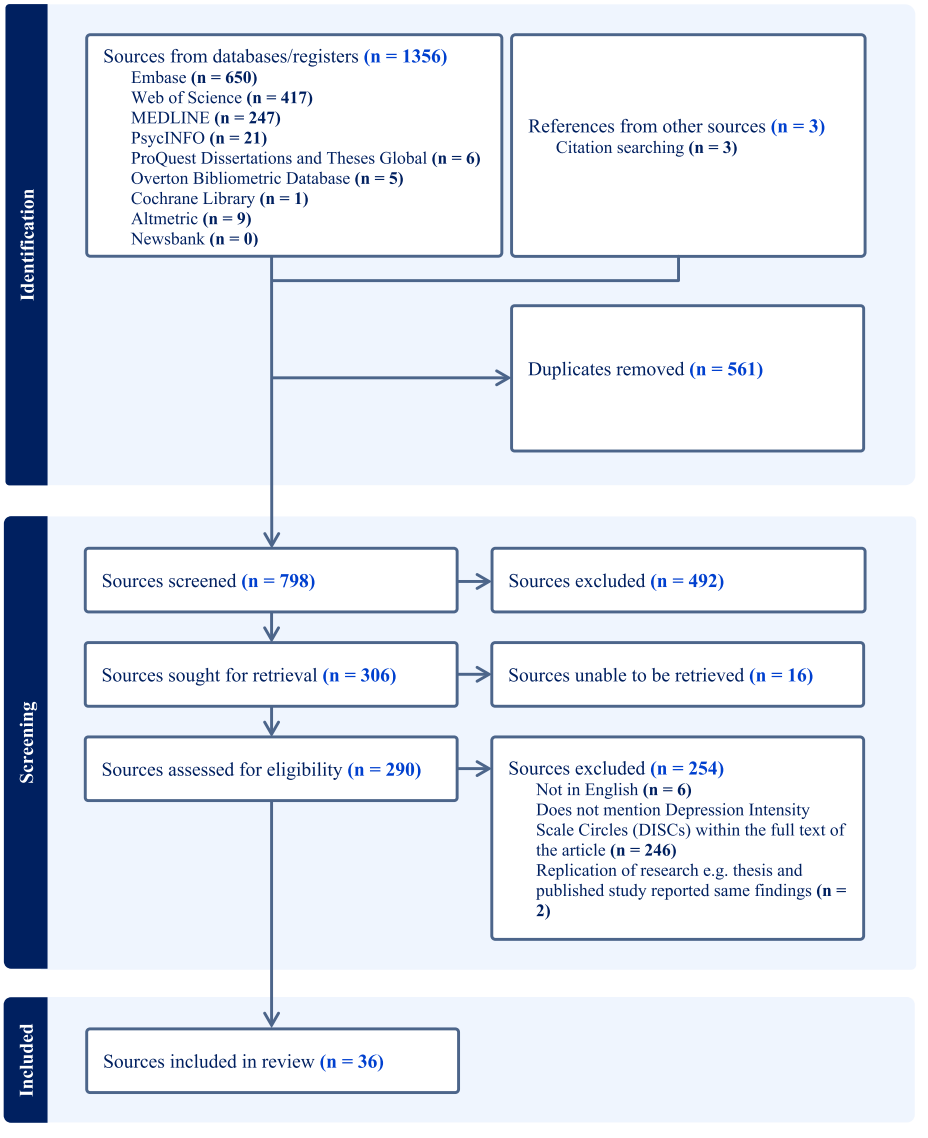

Figure 3. PRISMA flowchart.

source could not be retrieved (n = 16). The authors attempted to search for these unretrieved sources directly in the relevant journal or database, but were either met with an error message (e.g., because the link to the source was no longer available), or no search result was found.

Source characteristics

A description of characteristics of included sources is provided in Appendix C (excluding n = 9 sources from Altmetric; see below). Sources were published between 2005 and 2023, with a fairly consistent publication rate between 2010-2023. Eighty-one percent of sources (n = 22) were written by authors based in the UK. Fifty-six percent of the sources were research publications; see Table 1 for a full breakdown of source types. Across sources, the DISCs was most often used as an outcome measure to determine whether there was a change in how depressed a participant felt after treatment (30%, n = 8) and as a screening measure to determine whether an individual should be further assessed for depression (18%, n = 5). The DISCs was also analysed in a systematic review (15%, n = 4), referenced in a literature review (11%, n = 3), assessed for frequency of usage in certain settings (11%, n = 3), used as part of a formal validation study (11%, n = 3) or recommended in guidelines (4%, n = 1). Only three sources directly measured the validity of the DISCs.

The DISCs was administered to participants in 16 sources. It was most commonly administered to people who had experienced stroke (n = 13), though it has also been utilized with Huntington's disease (n = 2), traumatic or otherwise unspecified brain injury (n = 2), and in populations with unspecified neurological disorders (n = 2; note that the total is greater than 16 due to some sources having participants with different diagnoses). Most studies did not measure the degree of cognitive impairment of their participants. Williams et al. (2011) reported using the Northwick Park Examination of Cognition (NPEC; Williams et al. (2016)) to measure the cognitive impairment of participants, but did not

Table 1. Type of sources included in scoping review.

Source type	Total
Grey literature	12
Guidelines	1
Poster abstract	7
Thesis/dissertation	3
Other: grey literature	1
Published research	15
Research paper	11
Systematic review	3
Other: published	1
Grand Total	27

Note. Types of sources are grouped by grey literature and published research. Altmetric results are not included. "Other: grey literature" is a clinical trial registration, while "Other: published" is a published paper on guidelines for screening for depression.

provide the results. Only two studies measured whether cognitive impairment was present and subsequently reported the results (Lees, Broomfield, et al., 2014a; Rose & Perez Algorta, 2018). Both used the Montreal Cognitive Assessment (MoCA; Nasreddine et al., 2005). The MoCA is used to screen for mild cognitive impairment (Freitas et al., 2013) and thus has only been validated to distinguish between participants with mild cognitive impairment or no cognitive impairment. Lees, Broomfield, et al. (2014a) reported 82% of their sample met the cut-off for mild cognitive impairment at baseline. Rose and Perez Algorta (2018) reported that "on average most participants were experiencing mild cognitive impairment" (chapter 2, p.13), though did not report an exact percentage of participants. They noted that scores ranged from 11-29, with the traditional cut-off being 26 (Nasreddine et al., 2005). Three studies reported excluding participants who had cognitive impairment that inhibited the participant from providing informed consent, and four studies reported excluding participants with communication difficulties.

Almost all sources that utilized the DISCs with participants administered the DISCs in a hospital setting (n = 11), including in stroke units and rehabilitation units. The DISCs was most often used or recommended to measure depression (67%), followed by mood (26%); the remaining 7% of sources either did not specify what the DISCs measured or stated it measured distress. Many sources did not report the cut-off point used for the DISCs, however of those that did (n = 6), greater than or equal to 2 was always used. Further, the administration of the DISCS was only reported to be modified in three sources; one stated that the DISCs was administered in the participant's native language (language not specified), another utilized the BASDEC question on suicidal ideation at the clinician's discretion, while another used the addition of a smiling face and a sad face at either end of the DISCs' visual scale (see Figure 4).

Nine sources were identified from Altmetric, a database that tracks references to research in online sources such as social media and news outlets. These sources are discussed separately to the other sources as they have markedly different characteristics. See Appendix D for a breakdown of these sources. Due to the lack of insight that these sources provide to the research question, the information provided below excludes them.

Psychometric properties of the DISCs

Table 2 identifies the three sources that formally examined the psychometric properties of the DISCs. The DISCs was validated in stroke (Lees, Stott, et al., 2014b; Turner-Stokes et al., 2005) and Huntington's disease (De Souza et al., 2010) populations. Predictive validity was measured in all three sources, with sensitivity ranging between 60%-92%, specificity ranging from 78%-87%, positive predictive value ranging from 50%-75% and negative predictive value ranging from 77%-97%. All three sources concluded that the DISCs is a valid

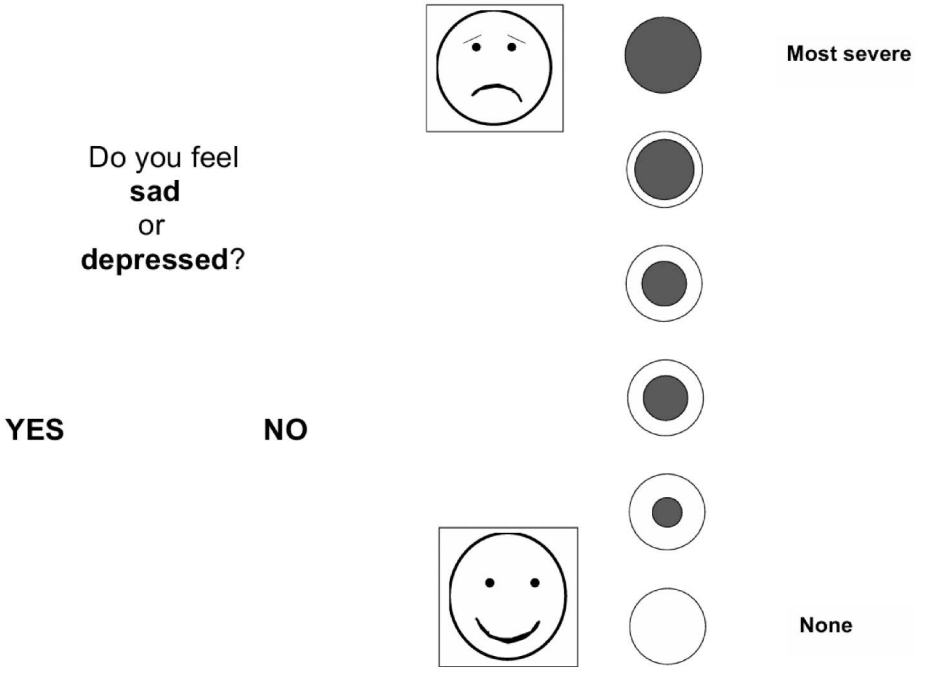

Figure 4. DISCs Variation: Sad and Smiling Face. Note. The DISCs with sad and smiling faces included in Lees, Stott, et al. (2014b) to support comprehension of the scale. Reproduced with permission, Lynne Turner-Stokes, King's College London (https://www.kcl.ac.uk/nmpc/assets/rehab/discs-booklet-with-pictures-grey.pdf).

tool for screening depression in individuals with either stroke or Huntington's disease, though it was noted in all three sources that further research is required with individuals with severe cognitive and communicative impairment (De Souza et al., 2010; Lees, Stott, et al., 2014b; Turner-Stokes et al., 2005). Turner-Stokes et al. (2005), who reported the lowest sensitivity and negative predictive value, further acknowledged the trade-off between the simplicity of the DISCs and its inevitably poorer psychometric properties, compared to other, more detailed screening measures of depression and mood, as more detailed measures are not always feasible in the context of moderate to severe cognitive or communicative impairment. Turner-Stokes et al. (2005) also investigated concurrent validity, finding that the DISCs had a moderate correlation with DSM-IV criteria for depression, and sensitivity to change, finding a significant change in DISCs scores after treatment. Only Turner-Stokes et al. (2005) examined the test-retest reliability of the DISCs, which was described as excellent (weighted $\kappa = 0.84$).

One study did not formally identify psychometric properties of the DISCs but reported data that may be used to draw inferences about the sensitivity to change of the DISCs. Blake et al. (2024) identified that there was no significant difference in the number of scores above the DISCs' cut-off score of two after treatment compared to before treatment. These results may suggest poor

Table 2. Sources formally examining psychometric properties of the DISCs.

Source	Population	Reference Standard	Comparators	Psychometric Properties Reported
Turner-Stokes et al. (2005)	Stroke	DSM-IV criteria	Beck Depression Inventory – 2nd Edition (BDI-II) Numerical graphic rating scale (NGRS)	Concurrent validity: significant correlation with DSM-IV (Spearman rank correlation r = 0.59). Also with BDI-II (r = 0.66) and with NGRS (r = 0.87). Predictive validity: Compared to depression diagnoses made using DSM-IV criteria. Sensitivity of 60%, specificity of 87%, positive predictive value of 75% and negative predictive value of 77%. Test-retest Reliability: excellent agreement reported (weighted κ = 0.84) between repeat application of scales after a 24-hour interval. Sensitivity to change: In participants who received treatment, the DISCs identified a significant change in scores at pre – and post-treatment. This was significantly correlated with changes in BDI-II scores (Spearman r = 0.38) and (r = 0.77).
De Souza et al. (2010)	Huntington's Disease	Schedules for Clinical Assessment in Neuropsychiatry (SCAN) *Uses ICD-10 criteria*	BDI-II Hospital Anxiety and Depression Scale (HADS)	Predictive validity: Compared to depression diagnoses made using SCAN. Sensitivity of 92%, specificity of 82%, positive predictive value of 61% and negative predictive value of 97%. *No measures of concurrent validity were reported between DISCS and SCAN, BDI-II or HADS.*
Lees, Stott, et al. (2014b)	Stroke	Clinical diagnosis made at one-month follow-up assessment of depression	HADS	Predictive validity: Compared to depression diagnoses made at one-month follow-up. Sensitivity of 92%, specificity of 78%, positive predictive value of 50% and negative predictive value of 97%.

Note. Predictive validity refers to the ability of the tool to accurately predict a diagnosis of depression. Sensitivity refers to the probability of all positive cases of depression being identified by the tool; specificity refers to the probability of all negative cases being excluded by the tool. Positive predictive value is a measure of how often the tool tests positive for depression for someone who has depression (based on a gold standard measure). Negative predictive value is a measure of how often the tool tests negative for depression for someone who does not have depression. Concurrent validity refers to the correlation between the tool and other tools that measure the same construct. Test-retest reliability refers to the similarity between scores on the tool by the same person at different time points. Sensitivity to change refers to the ability of the tool to reflect changes in diagnosis over time (e.g., after treatment).

sensitivity to change for the DISCs. However, the treatment itself varied widely for different participants and may have not been effective in treating depression, making it very difficult to draw any strong conclusions about the DISCs' sensitivity to change. The authors themselves concluded that there was no effect of attending depression treatment sessions on clinical recovery from depression (Blake et al., 2024). No other sources reported results from which to draw inferences about other psychometric properties of the DISCs.

Recommendations about the DISCs

Fifteen sources made recommendations about the DISCs (see Table 3). The DISCs was recommended for use in in-patient settings (n = 3) and non-specified clinical settings (n = 1), and the recommended cut-off point was always greater than or equal to 2 (n = 2). There was an almost equal split between the number of sources concluding that the DISCs has sufficient psychometric properties for use in clinical or research settings (n = 4), and sources that concluded that the psychometric properties are insufficient (n = 5). Table 4 synthesizes the populations for which the DISCs was recommended as a screening measure. Stroke was the most frequently recommended population (n = 6), with the DISCs specifically recommended for those with either cognitive impairment or communication difficulties in addition to stroke. The DISCs was more generally recommended for screening for depression or low mood in Acquired Brain Injury (ABI; n = 2). The DISCs was also recommended for use in populations with Huntington's disease (n = 1). Conversely, three sources recommended that the DISCs should not be used in people with stroke, ABI or Huntington's disease due to insufficient data on the validity and reliability of the DISCs in these populations. No differences were noted between the date of publication and the recommendations made, such that the recommendations made about the DISCs do not appear to have changed over time.

Discussion

The aim of this scoping review was to explore and systematically map the current research and grey literature regarding the DISCs, drawing conclusions about the psychometric properties of the DISCs and how it is being used and recommended both in research and in practice. Thirty-six sources published between 2005–2023 were identified, with the DISCs used either as a screening or outcome measure, as part of a literature review or systematic review, included in (or excluded from) guidelines, or in a social media post. Because results were not restricted to a specific neurological condition, a more comprehensive breadth of research regarding the DISCs in different populations (i.e., acquired brain injury, especially stroke, and Huntington's disease) was identified and examined.

Table 3. Source conclusions and recommendations regarding the DISCs.

Source	Conclusions and Recommendations about DISCs			
	Population	Psychometric	Setting	Administration
Barrows (2016)	Recommended for people with stroke and aphasia. Difficulties quantifying abstract concepts into numerical scores, or who have hemi-spatial neglect.	Not enough psychometric evidence DISCs to be recommended for use.	Nil	Nil
Blake et al. (2024)	Nil	Concerns about floor effects for people already scoring low on DISCs at beginning of treatment. Concerns about inadequate sensitivity.	Nil	Nil
Burton and Tyson (2015)	Not recommended for use in stroke populations.	DISCs did not meet sensitivity (greater than or equal to 80%) and specificity (greater than or equal to 60%) requirements of the review for inclusion.	Nil	Nil
De Souza et al. (2010)	Recommended for screening for depression in Huntington's disease (HD). Need for further testing with populations with severe cognitive impairment and with severe depression.	DISCs was found to have greater criterion validity than previously reported in first validation study by Turner-Stokes et al. (2005).	Nil	Nil
Gurr (2011)	Recommended for use with people with stroke and with cognitive and communication difficulties.	Nil	Included into a mood screening pathway used in an inpatient stroke rehabilitation unit.	Nil
Kneebone et al. (2010)	Recommended for use with people with stroke-related cognitive and communication difficulties.	Nil	Recommended for inclusion into the specified protocol to be used in a stroke unit.	Nil
Lees, Stott, et al. (2014b)	Recommended for use in people with stroke-related cognitive impairment. Specifically recommended during acute stage of stroke.	Found to have more favourable accuracy for predicting clinically important depression at one month compared to the HADS.	Nil	Nil
Lees, Broomfield, et al. (2014a)	Nil	Nil	The third most utilized measure by allied health and medical staff in Scottish NHS hospital stroke units (utilized by 6% of the staff assessed).	Nil
McLean et al. (2019)	Nil	Does not have adequate sensitivity and specificity for detecting depression, based on Burton and Tyson (2015), and was not included in the clinical practice guideline developed.	Nil	Nil

(*Continued*)

Table 3. Continued.

Source	Conclusions and Recommendations about DISCs			
	Population	Psychometric	Setting	Administration
Mestre et al. (2016)	Suggested but not recommended for use in Huntington's disease for screening for depression, due to lack of available data and the need for further assessment.	Nil	Nil	Nil
Morris et al. (2012)	Identified as a possible simplified tool for screening depression in people with stroke-related cognitive/communicative impairments, but was not included in the study's protocol.	Nil	Nil	Nil
Rose et al. (2023)	Unable to draw significant conclusions about use with ABI and severe cognitive or communicative difficulties due to not having been used in this population.	Gave an indeterminate COSMIN rating for reliability, hypothesis testing and responsiveness due to lack of information.	Nil	Nil
Turner-Stokes and MacWalter (2005)	Recommended as a basic screening tool for depression in people with ABI, specifically where depression is suspected (rather than as a general screening tool to be used with all ABI patients in a clinical setting). Further recommended for use with people with communication or cognitive difficulties, but who have adequately preserved visuo-spatial skills.	Nil	Recommended in clinical settings (not specified).	Nil
Turner-Stokes et al. (2005)	Recommended in people with communication or cognitive difficulties following acquired brain injury, but who have adequately preserved visuo-spatial skills. More study is needed in participants with more profound language and cognitive deficits.	Performed well compared to similar measures (i.e., NGRS) and performed better than the Yale Question. Reported a high level of agreement between BDI-II and DISCs. Identified DISCs as having adequate convergent validity, reliability and responsiveness as a simple graded screening tool.	Nil	Cut-off of greater than or equal to 2 was identified. Method of administration is described in the article.
Tyson et al. (2013)	Recommended for stroke patients who are not showing symptoms of delirium, have a language problem but no visual impairment.	Included in guidelines despite not reaching sensitivity and specificity criteria. The authors considered it important for tools to be included that can be used with people with communication and cognitive problems.		Recommended administration and cut-off point of ≥ 2 based on Turner-Stokes et al. (2005).

Note. Only sources that made conclusions or recommendations about the DISCs are included (n = 15). Recommendations are organized under four categories: Population, Psychometric, Setting and Administration. Abbreviations: ABI = Acquired Brain Injury; BDI-II = Beck Depression Inventory 2nd Edition; HD = Huntington's Disease; HADS = Hospital Anxiety and Depression Scale; NGRS = Numerical Graph Rating Scale.

Table 4. Population recommendations for the DISCs.

Recommended	**9**
Acquired brain injury	
Cognitive impairment and/or communication difficulties	2
Huntington's disease	
General	1
Stroke	
Cognitive impairment	4
Communication difficulty (e.g., aphasia)	2
Not Recommended	**3**
Acquired brain injury	1
Huntington's disease	1
Stroke	1
Grand Total	**12**

Note. Twelve sources in total made recommendations about the populations for which the DISCs should or should not be used. Recommendations for populations are further broken down to the subpopulation that the DISCs was recommended for (e.g., cognitive impairment in stroke).

Three studies were identified that examined the psychometric properties of the DISCs. The original validation study of the DISCs from Turner-Stokes et al. (2005) is often cited in other sources as demonstrating that the DISCs has poor validity (Barrows, 2016; Burton & Tyson, 2015; McLean et al., 2019; Rose et al., 2023). However, this scoping review includes newer studies that report stronger predictive validity than Turner-Stokes et al. (2005; De Souza et al., 2010; Lees, Broomfield, et al., 2014). While these results should still be interpreted cautiously due to the limited amount of data currently available, they add further support for the use of the DISCs as a valid screening tool for depression.

The findings of this scoping review suggest that despite the limited study of the psychometric properties of the DISCs, it continues to be recommended and included into guidelines for depression screening, especially in in-patient stroke settings in the UK. It appears that the practical utility of the DISCs is of particular importance to researchers and clinicians alike when working with populations with neurological disease or injury and subsequent moderate-to-severe cognitive impairment. This practical utility is so important that it often outweighs the psychometric properties of the DISCs when authors consider what screening measures to recommend. A clear example is the disparity between Burton and Tyson (2015), a systematic review that did not recommend the DISCs based on strict sensitivity and specificity criteria, compared to broader guidelines published by the same authors (Tyson et al., 2013). These guidelines recommended the DISCs for screening depression in impaired populations, despite its poorer psychometric properties. The authors emphasized the need for screening tools that can be utilized with populations that would otherwise be unable to use verbal self-report measures, even if the psychometric properties of these screening tools are comparatively poorer.

The trade-off between psychometric properties and practical utility forms part of the broader discussion of barriers to depression screening in

neurological disease or injury populations. Barriers to screening include the impact of cognitive impairment on the ability to use the tool, the length of time taken to use many screening tools and limited awareness of or comfort with using depression screening tools by health professionals (Swartz et al., 2016). The DISCs overcomes the first two of these barriers, as it can be utilized with many individuals with cognitive impairment and is very quick to administer. It is hoped that this scoping review helps to overcome the third barrier by building awareness of the DISCs and increasing health practitioners' confidence in using the DISCs with a variety of populations.

Limitations

A key limitation of the research included in this scoping review is the heavy reliance on the original validation study by Turner-Stokes et al. (2005) when making recommendations about the DISCs, as identified above. This suggests that the recommendations in these sources do not consider the full breadth of the literature on the DISCs and may be limited. This scoping review aims to provide a more comprehensive understanding of the strengths and limitations of the DISCs by incorporating all literature published to date. In sources where the DISCs was administered to participants, the level of cognitive and communicative impairment experienced by these participants was often not reported. It is therefore difficult to extrapolate the validity of the DISCs with populations with moderate-to-severe cognitive impairment. While many sources recommended the DISCs for use in these populations, this was based on the clinical utility of the DISCs in these populations, rather than on its psychometric properties.

This scoping review has several methodological limitations. While the study followed rigorous review methods and a pre-published protocol, the change from systematic review to scoping review meant that some changes were made to the data extraction process. As these changes occurred during the full-text screening process when the author had been exposed to some of the information available in the included full-text sources, there is potential for bias. However, data extraction in scoping reviews is often an iterative process (Pollock et al., 2023), so while this deviation from the pre-published protocol was not ideal, it may have been expected to occur regardless of the late shift to scoping review methodology.

A limitation of significant concern is the discovery of missing sources after the completion of this scoping review. A review of these sources led to the identification of a relevant database not included in this search strategy. The CINAHL database provides indexing for 3000 journals in nursing and allied health. A preliminary search of the CINAHL database in October 2024 using the search term "Depression Intensity Scale Circles" identified at least four sources that reference the DISCs that were not identified in the current search strategy (Baker et al., 2022;

Mavaddat et al., 2017; McGinnes, 2009; Silkes, 2023). The sources recommended the DISCs as a mood screening tool for people with aphasia, stroke or more generally for acquired brain injury (Baker et al., 2022; McGinnes, 2009) or used the DISCs as a screening tool to exclude depressed participants from research (Mavaddat et al., 2017; Silkes, 2023). In future research in similar areas, it is strongly recommended that allied health databases are included into the search strategy. There is significant crossover in allied health disciplines when supporting people with neurological disease or injury, making screening for depression important to professions outside of psychology.

In addition to these omissions, five further sources were identified when reviewing the CINAHL database. These sources were found using the current search strategy but were excluded at the abstract and title screening stage of this project (Kneebone et al., 2014; Silkes, 2015; Silkes et al., 2013; Silkes & Rogers, 2012; Tabrizi et al., 2022). These sources used the DISCs as a depression screening measure (Silkes, 2015; Silkes et al., 2013; Silkes & Rogers, 2012; Tabrizi et al., 2022), or referenced the DISCs as the template for a similar anxiety rating scale (Kneebone et al., 2014). On review, it appears that these sources were excluded because their titles and abstracts did not provide any reference to the DISCs, or to mood or depression screening (see Appendix E for the full titles and abstracts). This points to a significant flaw in using a title and abstract screen to identify all mentions of a concept in the literature, no matter how small.

To avoid this issue in future research, there are several options. One option would be to screen all sources at the full-text level, a significantly more time-consuming process. Alternatively, to better balance the need for screening accuracy with the practical time constraints of this project, two different screening methods may be used, dependent on the database search strategy. As identified in the methodology, two search strategies were used, depending on whether the database searched the full text or only the title and abstract of each source (see Appendix A). The search strategy for databases that searched the full text was more targeted and the sources identified automatically met the inclusion criteria of mentioning the DISCs. In future research, these sources could be moved straight to full-text screening, avoiding the risk of exclusion at the title/abstract screening stage. Sources identified in databases that searched only the title and abstract required a more general search strategy that captured many sources that did not mention the DISCs. These sources could feasibly continue to be screened at the title/abstract level to reduce the number of unrelated sources included for full text screening.

Conclusions

It is difficult to definitively conclude whether the DISCs is an appropriate screening measure for depression in populations with cognitive and communicative

impairment when comparing the limited evidence about the psychometric properties of the DISCs with its practical utility. Further research is required to explore the psychometric properties of the DISCs, with meaningful consideration of how individuals with significant cognitive and communicative impairments can be included into this research. It is important that the "gold standard" measure against which the DISCs is compared is accessible to people with cognitive and communicative impairment. The inclusion of a proxy assessment (where a carer answers questions about the individual) by an appropriately qualified clinician may be an example of an accessible "gold standard" measure. Conclusions drawn from research on the psychometric properties of the DISCs must also weigh up the results with the practical utility of the DISCs, as this scoping review suggests that this is highly important in clinical settings.

It is important that research continues to identify and study screening tools that are appropriate for those with moderate-to-severe cognitive and communicative impairments. Further, it is vital that depression screening tools are appropriately supported by strong psychometric studies, as these results have a significant impact on the mental health support provided to an individual with neurological disease or injury. The DISCs continues to be an appropriate candidate for further research to fulfill these needs.

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ORCID

Catherine E. L. Ford http://orcid.org/0000-0002-8646-9402

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