Chapter 11
Six-Item Cognitive Impairment Test (6CIT)

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Contents

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A.J. Larner (ed.), *Cognitive Screening Instruments*,
DOI 10.1007/978-3-319-44775-9_11

Abstract The Six-item Cognitive Impairment Test (6CIT) was designed to assess global cognitive status in dementia. Developed in the 1980s as an abbreviated version of the 26-item Blessed Information-Memory Concentration Scale, the 6CIT is an internationally used, and well-validated, screening tool. It was designed principally for use in primary care, but has also found application in secondary care settings. It has been compared favorably to the Mini-Mental State Examination (MMSE) due to its brevity and ease of use, and there are data to suggest that it is now used more frequently than the MMSE in primary care settings. Some evidence suggests that it outperforms the MMSE as a screening tool for dementia, especially in its mildest stage. The 6CIT has been translated into many different languages. It comprises six questions; one memory (remembering a 5-item name and address), two calculation (reciting numbers backwards from 20 to 1 and months of the year backwards) and three orientation (year, month, and time of day). The time taken to administer 6CIT is approximately 2 min, which compares favorably to other screening instruments. However this brevity has also been seen as disadvantageous, with the suggestion that more features of dementia can be detected using more comprehensive screening tools. Criticisms that the scoring system is too complex have been raised, but distribution of 6CIT with computer software may go some way to resolving this. In summary, the 6CIT is a brief, validated screening tool that may be preferable to the MMSE. Since a typical UK primary care consultation stands at only 7.5 min, the brevity and simplicity of the scale are its greatest advantages.

Keywords Dementia • Alzheimer's Disease • Cognitive Impairment • Test Screening

11.1 Introduction

The Six-item Cognitive Impairment Test (6CIT) is a short questionnaire for assessing global cognitive status in dementia [1]. It is an abbreviated version of the 26-item Blessed Information-Memory Concentration scale [2], and is sometimes known as the Short Blessed Test (SBT). 6CIT was popularized in the United Kingdom (UK) by Brooke and Bullock [3], whence it is sometimes known as the Kingshill test or version.

The scale is popular in both the UK and the USA and has been widely used across different nationalities [4], especially in primary care. Validated in a number of studies (e.g. [1, 3]), the 6CIT has been suggested as a favorable alternative to the Mini-Mental State Examination (MMSE; see Chap. 3) [5] owing to its brevity and simplicity of use. With the average duration of a typical UK primary care consultation being only 7.5 min, cognitive screening instruments must be brief if they are to be administered in the available time. Advantages of the 6CIT in comparison with the MMSE include its short administration time; ease of use for prac-

titioners; and simplicity for patients – for example, it does not include a figure copying section, thereby allowing individuals with visual impairment [6] and tremors to complete the questionnaire. No specific equipment is required to perform the test.

Although the 6CIT is brief, there is some evidence that it can outperform the MMSE in detecting dementia, particularly at its mildest stage [7]. Limitations of the MMSE have been discussed in comparison studies investigating multiple screening tools for cognitive impairment. Findings have frequently highlighted the insensitivity of MMSE to mild cognitive impairment (MCI) and mild Alzheimer's disease (AD) [8], with MCI often testing in the 'normal' range on the MMSE [9]. Moreover 35–50 % of early AD cases are missed when the classic MMSE cut-off is used [10, 11].

As part of their annual check up in a primary care setting, 709 participants over the age of 80 years were asked to complete the MMSE [12]. Individuals who scored at or below the standard MMSE cut-off point of 26/30 were then asked to complete the GMS–AGECAT (GMS) diagnostic system [13] to further identify case level dementia. Two hundred and two individuals were assessed on the GMS and of those, 29 (14 %) were found to have dementia. The MMSE cut-off used resulted in a false-positive rate of 86 %. Improvements in predictive value were made by adopting more stringent MMSE cut-off points of 24/30 and 21/30, but this still resulted in false-positive rates of 78 % and 59 % respectively. These results further suggest that the MMSE may not be the ideal screening instrument for dementia in primary care [12]. Nevertheless, MMSE has remained widely and frequently used [14].

A postal survey study investigating the use of cognitive screening instruments in primary care in the UK reported that 79 % of practices used at least one dementia screening tool, including: the MMSE and its variants (51 %), the Abbreviated Mental Test (AMT) (11 %), MMSE and AMT (10 %), MMSE and Clock Drawing Test (CDT; see Chap. 5) (8 %), MMSE and 6CIT (6 %), and the CDT (5 %) [15]. It is important to note, however, that these findings may be limited to suggesting the intention by practices to use these scales rather than actual usage figures. A series of studies looking at primary care cognitive screening instrument use based on reports in referral letters to a dedicated secondary care cognitive disorders clinic has documented a gradual increase in documented 6CIT use [16–19], such that it now appears to be used more frequently than the MMSE [19]. However, there are likely to be wide geographical disparities in 6CIT use, for example it did not feature at all in a survey of the preferences of Canadian psychogeriatric clinicians [20].

The 6CIT is easily translated into other languages, as demonstrated by Barua and Kar in an investigation of depression in elderly Indian patients [21]. The 6CIT was used to assess cognitive impairment in individuals over 60 years of age and was translated into both Hindi and Kannada for the purposes of the study. To ensure its correct translation, Barua and Kar asked a study-blind psychiatrist to translate the test back into English, where it was found to remain textually correct to the original.

Table 11.1 Item content of the 6CIT, acceptable responses, and scoring criteria

Question 1 – What year is it? (**Orientation**) The exact year must be given, however an incomplete numerical value for the year (e.g. 11 instead of 2011) is accepted as correct Scoring: The patient will score 0 for a correct answer and 4 for an incorrect answer
Question 2 – What month is it? (**Orientation**) The exact month must be given, however a numerical value for the month (e.g. 10 for October) is accepted as correct Scoring: The patient will score 0 for a correct answer and 3 for an incorrect answer
Question 3 – Memory – Part 1 In this part of the questionnaire, the practitioner gives the patient a name and address with five components to remember, e.g., John, Smith, 42, High Street, Bedford (this is to be recalled after question 6). The practitioner should say "*I will give you a name and address to remember for a few minutes. Listen to me say the entire name and address and then repeat it after me*." The trial should be re-administered until the subject is able to repeat the entire name and address without assistance or until a maximum of three attempts. If the subject is unable to learn the entire name and address after three attempts, a "C" should be recorded. This indicates the subject could not learn the phrase in three tries. Whether or not the name and address is learned, the clinician should instruct "Good, now remember that name and address for a few minutes"
Question 4- About what time is it? (**Orientation**) A correct response should be given without the participant referring to a watch or clock and should be accurate to ±1 h. If the answer given is rather vague (e.g. "almost 2 pm") the patient should be prompted for a more specific answer Scoring: The patient will score 0 for a correct answer and 3 for an incorrect answer
Question 5- Count backwards from 20 to **1** (**Calculation**) If the patient skips a number after 20, an error should be recorded. If the patient starts counting forward or forgets the task at any point, the instructions should be repeated and an error recorded Scoring: The patient will score 0 for a correct answer (no errors), 2 points for 1 error and 4 points for more than 1 error
Question 6 – Say the months of the year in reverse (**Calculation**) To get the subject started, the examiner may state, "*Start with the last month of the year. The last month of the year is*: (*patient to fill in the gap*)" If the patient cannot recall the last month of the year, the examiner may prompt with "December". However, one error should be recorded. If the patient skips a month, an error should be recorded. If the patient begins saying the months forward upon initiation of the task, the instructions should be repeated and no error recorded. If the patient starts saying the months forward during the task or forgets the task, the instructions should be repeated and one error recorded Scoring: The patient will score 0 for a correct answer (no errors), 2 points for 1 error and 4 points for more than 1 error
Memory – Part 2 – Repeat the name and address I asked you to remember The patient should state each item verbatim. The address number must be exact (e.g. 420 instead of 42 is incorrect). Omitting the thoroughfare term (street, road, drive, crescent) from the street-name or substituting it for a different one will not constitute an incorrect answer-score as correct Scoring: The patient will score 0 for a correct answer (no errors), 2 points for 1 error, 4 points for 2 errors, 6 points for 3 errors, 8 points for 4 errors and 10 points if they got all of the components wrong

Further evidence for multilingual translation of 6CIT is suggested by Broderick, in which a modified 6CIT was used in the Xhosa language of South Africa [22]. The 6CIT is also used in two parallel versions for use in British and American populations [23].

11.2 6CIT: Item Contents

The 6CIT comprises one memory question, two calculation questions and three orientation questions. In Table 11.1, these are discussed in more detail in relation to scoring criteria and acceptable responses.

Unlike the majority of cognitive screening instruments, 6CIT uses an inverse scoring method (0–28, normal to impaired) with question scores weighted to produce the total score out of 28 (see Table 11.1 for scoring method).

The original validation of the scale by Katzman et al. [1] suggested a score of 6 points or less to be a normal score, with scores of 7 or higher warranting further investigation to rule out a dementia-related disorder. However, based on the clinical research findings of Morris et al. [4], more specific criteria may be given, namely:

Score 0–4: Normal cognition
Score 5–9: Questionable impairment
Score ≥10: Impairment consistent with dementia (evaluate further).

Other sources, such as online software used in primary care settings in the UK (see www.patient.co.uk/doctor/six-item-cognitive-impairment-test-6cit), consider scores of 0–7 normal and ≥8 significant. The exact cutoff used may, obviously (see Chap. 2), influence test metrics [24].

The 6-CIT takes approximately 2 min to complete.

11.3 Diagnostic Utility

Sensitivity of 6CIT was measured by Brook and Bullock [3], who conducted a study to compare the 6CIT, MMSE [5], and the Global Deterioration Scale (GDS) in a sample of 287 community and outpatient participants, comprising 137 controls, 70 with mild dementia (GDS 3–5), and 82 with more severe dementia (GDS 6–7). A sensitivity of around 80 % was reported for the 6CIT, which was considerably higher than that of the MMSE (50–65 %, depending on cut-off). Although the 6CIT scores correlated highly with the MMSE scores, its superior sensitivity led the researchers to conclude that the 6CIT was a better tool for detecting mild dementia [3].

A recent study confirmed the results of Brooke and Bullock [3]. The study, conducted by Upadhyaya et al. [23], compared the performance of the 6CIT with the MMSE in a sample of 209 participants with a mean age of around 79 years. Individuals with and without dementia were retrospectively studied from data provided by an old age psychiatry service. The study reported a sensitivity of 82.5 % and a specificity of 90.9 % at a 6CIT cut-off of 10/11. When the cut-off was lowered to 9/10 the sensitivity of the scale increased to 90.2 % but the corresponding specificity decreased to 83.3 %. When compared with the MMSE, the two scales had a very strong negative correlation ($r = -0.822$) and the MMSE had a lower sensitivity and specificity of 79.7 % and 86.4 % respectively. When analyzing the Receiver Operating Characteristic (ROC) curves for the MMSE and 6CIT, Upadhyaya et al. also showed superior screening properties of the 6CIT over the MMSE for dementia [23].

In a very similar study into the use of the 6CIT and MMSE, Tuijl et al. asked 253 general hospital patients over the age of 70 years to complete both tests [25]. Similarly to the previous two studies mentioned, a very high negative correlation was found between the 6CIT and MMSE ($r = -0.82$). This study adjusted the cut-off points in the MMSE for subjects with low (<19/30) and high (<23/30) educational level, comparable with the >11 cut-off on the 6CIT which was not sensitive to educational level. The study found sensitivity and specificity scores of 6CIT to be 0.90 and 0.96 respectively with a positive predictive value of 0.83 and negative predictive value of 0.98. The area under the ROC curve was reported as 0.95. This study, as in previous research, concluded that 6CIT is a suitable screening instrument for cognitive impairment in a general hospital setting owing to its brevity and ease of use for both patients and professionals [25].

The utility of 6CIT in primary care settings was questioned by Hessler et al. [26]. In a population-based prospective trial, primary care practitioners administered 6CIT to nearly 4000 patients at routine examinations over a 2-year period, with incident dementia diagnoses being established at subsequent examination of health insurance records. 6CIT showed low sensitivity for dementia diagnosis (0.49 and 0.32 at 7/8 and 10/11 cutoffs respectively) but high specificity (0.92, 0.98 respectively). The authors concluded that 6CIT was not suited as a routine screening instrument in primary care [26].

Abdel-Aziz and Larner examined 6CIT as a cognitive screening instrument in a dedicated secondary care cognitive disorders clinic [27]. In a cohort of 245 consecutive patients with a dementia prevalence of around 20 %, 6CIT scores were highly negatively correlated with MMSE scores ($r = -0.73$; $t = 13.0$, $p < 0.001$). 6CIT had good sensitivity (0.88) and specificity (0.78) for dementia diagnosis at the specified cut-off of ≤4; MMSE was less sensitive (0.59) but more specific (0.85) at a cutoff of ≤22/30. For the diagnosis of MCI, 6CIT was again more sensitive (0.66; cutoff ≤9) than MMSE (0.51; cutoff ≤25/30) but less specific (0.70 vs 0.75). Area under the receiver operating characteristic (ROC) curve, a measure of diagnostic accuracy, was 0.90 (Fig. 11.1), 0.85, and 0.71 for the diagnosis of dementia vs. no dementia, dementia vs. MCI, and MCI vs. no cognitive impairment respectively. Weighted comparisons showed net benefit for 6CIT compared to MMSE for diagnosis of both dementia and MCI. Effect sizes (Cohen's d) for 6CIT were large for dementia diagnosis (1.89) and moderate for MCI diagnosis (0.65), again comparable with MMSE

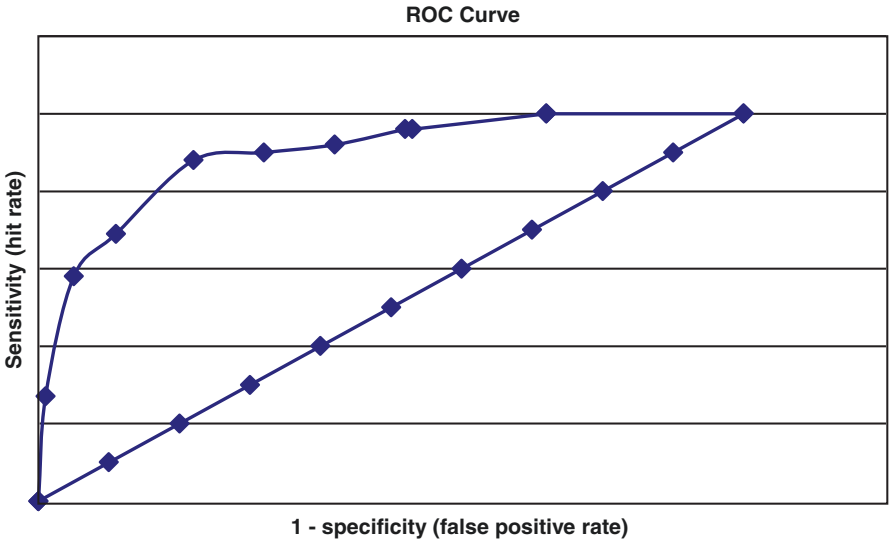

Fig. 11.1 Receiver operating characteristic (ROC) curve for 6CIT for diagnosis of dementia versus no dementia (Based on data from [27])

(1.34 and 0.70 respectively) [27]. Analyzing the same dataset but using the 6CIT 7/8 cutoff (as per www.patient.co.uk/doctor/six-item-cognitive-impairment-test-6cit) marginally increased sensitivity but reduced specificity for dementia diagnosis [24].

6CIT has been compared with other cognitive screening instruments using summary or comparative measures. As for MMSE, 6CIT scores are highly negatively correlated with scores on the Mini-Addenbrooke's Cognitive Examination (M-ACE; see Chap. 6) with $r=-0.79$ ($t=9.4$, $p<0.001$), and negatively correlated with scores on the Montreal Cognitive Assessment (MoCA; see Chap 7) with $r=-0.54$ ($t=2.8$, $p<0.02$) (Larner, unpublished observations).

The large effect size (Cohen's d) for 6CIT for dementia diagnosis is similar to a number of other CSIs examined in historical cohorts, including M-ACE, MoCA, Test Your Memory test (TYM; see Chap. 9), and the Addenbrooke's Cognitive Examination-Revised (ACE-R; see Chap. 6), but the medium effect size for diagnosis of MCI is inferior to that of MoCA and M-ACE [28, 29].

11.4 Advantages and Disadvantages

11.4.1 Time

The 6CIT takes as little as 2 min to complete [23]. This is much shorter than the commonly used MMSE (5–10 min). There are several other brief cognitive tests that can be used as screening instruments for dementia, which, in general, take less time to complete than the MMSE (Table 11.2). The General Practitioner Assessment of Cognition

Table 11.2 Timescales for brief cognitive screening instruments

Task	Time (mins)
Time and Change Test	0.4
Mental Alternation Test	0.5
Short Informant Questionnaire on Cognitive Decline in the Elderly	0.5
Ashford Memory Test	1
6 Item Cognitive Impairment Test	2
Clock Drawing Test	2
Mini-Cog	2–4
Abbreviated Mental Test	3
Memory Impairment Screen	4
General Practitioner Assessment of Cognition (GPCOG)	4.5
Short Test of Mental Status	5
Mini-Mental State Examination (MMSE)	5–10
7 min Screen	7.5
Rowland Universal Dementia Assessment Scale	10
Short and Sweet Screening Instrument	10
Cambridge Cognitive Examination	20

Adapted from Brodaty et al. [30]

(GPCOG; Chap. 10), Mini-Cog, and Memory Impairment Screen (MIS) are examples of other screening measures used for dementia, all of which have been recommended for use in primary care settings [30]. However Brodaty et al. suggested 5 min for completion of the 6CIT [30]. Even at 2 min, the 6CIT still presents a longer completion time than the Time and Change Test (T&C), the Mental Alternation Test (MAT), the Short Informant Questionnaire on Cognitive Decline in the Elderly (SIQ), and the Ashford Memory Test (AMT), all of which may be administered in 1 min or less.

However, the brevity of the scale may also be seen as a disadvantage. Other scales that take longer to complete, such as the GPCOG, may detect more features of dementia. The GPCOG comprises the testing of: time orientation, clock drawing (numbering and spacing as well as placing hands correctly), awareness of a current news event, and recall of a name and an address (first name, last name, number, street, and suburb). There is also an informant interview. Longer screening instruments (over 10 min in duration) may probe a greater number of cognitive domains (i.e. have more questions to allow deeper enquiry), but due to their length would not generally be used in general practice (e.g. Cambridge Cognitive Examination, CAMCOG). There is some evidence for a trade-off between diagnostic accuracy and surrogate measures of test administration time for commonly used brief cognitive screening instruments [31, 32].

11.4.2 Content

Although the 6CIT takes slightly longer to administer than four of the other screening tools (see Table 11.2), it probes a higher number of cognitive functions than the shorter tests. For example, the Time and Change Test includes the patient being

asked to read the time from a watch or clock and then asked to make a desired amount of money from a selection of coins given; the Mental Alternation Test requires patients to count from 1–20, recount the alphabet, and then alternate the two (1A, 2B, 3C, 4D, etc.); the Short Informant Questionnaire on Cognitive Decline in the Elderly is completed by a relative or friend, asking how much the patient has declined in certain everyday situations.

The test uses a simple language that can be understood by individuals of differing educational levels. This important consideration was further illustrated in Tuijl et al. [25] who showed that 6CIT is not sensitive to educational level, thus making it a preferable screening tool over many others, including the MMSE, in which cut-off scores (ideally, but often not in practice) need to be adjusted to account for patient educational level.

11.4.3 Scoring

The scoring system for the 6CIT is rather complex compared with other screening tools for dementia. In a 12-month survey of errors in the scoring and reporting of cognitive screening instruments administered by primary care clinicians to patients who were subsequently referred to a cognitive disorders clinic, a minimum of 26 % of patients administered 6CIT had evidence of incorrect use or documentation, as compared to 32 % with the GPCOG and 13 % with MMSE [33]. The use of negative scoring in the 6CIT is perhaps counterintuitive (e.g. a report from a primary care clinician of a patient scoring "only 2/28" on 6CIT, a normal score [33]), and certainly contrary to most other brief cognitive screening instruments.

This scoring methodology may perhaps account, at least in part, for 6CIT use having been less widespread than the MMSE in general practice [15], although this may now have reversed [19, 33]. This complex scoring system may even be suggested to counteract the advantage of its brevity. However, as discussed by Brooke and Bullock [3], the plan for the 6CIT to be distributed through general practice surgeries would involve the scores from the test being analyzed by computer software, which would calculate the scores for each patient and advise whether further evaluations or referrals were necessary (e.g. www.patient.co.uk/doctor/six-item-cognitive-impairment-test-6cit).

11.4.4 Diagnosis of Dementia Subtypes

The 6CIT is not currently well researched for possible use in detecting differing types of dementia, such as AD, dementia with Lewy Bodies, and vascular dementia. However, due to its sensitivity in detecting cognitive impairment at the early stages of dementia, this would suggest its use in identifying all types of dementia early on. Research into the specific features of the test would need to be carried out to identify its capacity in

the recognition of different dementias. However, it seems likely that a much more detailed battery of tests would be required to distinguish subtypes of dementia.

Only a limited number of studies examining the use of 6CIT have been published to date [23–27]. One study shortlisted the 6CIT in its top eight tests for dementia (based on 16 separate criteria), however, 6-CIT did not rate as highly as others, such as the GPCOG, the Mini-Cog, and the Memory Impairment Screen (MIS), because it was deemed not easily available and was specifically penalized by "the paucity of evidence about its use" [15]. This unfamiliarity may have been the explanation for the otherwise extraordinary conflation of studies of 6CIT with those on the similarly named but entirely different Six-item Screener (SIS) [34] (see Chap. 4, at Sect. 4.2.3).

11.4.5 Visual Impairment

Because the 6CIT is entirely verbally presented and no specific equipment is required to perform the test, it is suitable for use in individuals with visual impairment [6] and may be administered by telephone [35].

11.5 Other Reported Uses

The use of the 6CIT has not been limited to studies of dementias but has been extended to cognitive impairment in other, physical, disorders. One such study investigated the association between metabolic syndrome (characterized by abdominal obesity, hypertriglyceridemia, low high-density lipoprotein cholesterol (HDL-C) level, high blood pressure, and hyperglyceridemia) and cognitive impairment and utilized the SBT as the scale of choice for detecting dementia in a large-scale study which included around 5000 women from 180 centers across 25 countries [36]. Further research using the SBT includes studies investigating associations between atherosclerosis and cognitive decline [37] and between physical activity and cognitive impairment [38]. The scale has even been utilized in the investigation of an acceptable screening tool in accident and emergency departments, with the SBT providing the best diagnostic test characteristics over the Ottawa 3DY, the Brief Alzheimer's Screen, and Caregiver-Completed AD8 (see Chap. 14) [39].

11.6 Conclusion

The 6CIT is a reliable, well-validated [3] and sensitive scale that can be easily used by professionals in primary care settings. Its brevity is its greatest advantage, along with uncomplicated instructions and the potential to be translated into different languages. Although not a diagnostic tool for dementia(s), it is indicative of cognitive

deficits, especially at the mild stages of dementia, thus surpassing the MMSE as a test of global cognitive status. It has also been compared to the Quick mild cognitive impairment (Qmci) screen (see Chap. 12) [40].

The notion that the 6-CIT detects dementia at its early stages raises the issue around the importance of early detection of dementia and commencing appropriate treatment. Nevertheless, some practitioners prefer other scales, such as the popular MMSE, a fact that may be influenced by the complicated scoring system of 6CIT and the relatively small amount of research conducted into its use. Recognition of 6CIT by the UK Royal College of General Practitioners, and the scope for computerized versions, should increase its use in general practice. Further evidence by way of large-scale studies should be conducted before the 6-CIT can begin to approach the widespread usage levels of scales such as the MMSE. Its simplicity and acceptability suggest that it might find a role in population-based screening should this ever become widespread, and perhaps as an online patient self-assessment instrument [41].

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