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T.O. Stair • J. Morrissey • I. Jaradeh • T.X. Zhou • J.N. Goldstein

Validation of the Quick Confusion Scale for mental status screening in the emergency department

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Abstract *Objective:* The Mini-Mental Status Exam (MMSE) is a commonly used assessment of cognitive status; however, it has been considered somewhat unwieldy for use in the emergency department (ED). An alternate test, the Quick Confusion Scale (QCS), has been compared against the MMSE in a single centre. We hypothesised that the QCS would strongly correlate with the MMSE in the ED, but could be administered more quickly. *Methods:* Trained research assistants administered both the QCS and the MMSE to a convenience sample of 666 patients and visitors in an urban academic ED. Patients were randomised as to which test would be administered first. *Results:* The QCS required less time to complete than the MMSE (2.7±1.3 *vs*. 5.1±1.9 min, $p<0.0001$). Nine patients could not complete the MMSE because they could not use their hands to write and four because of vision impairment. Correlation of QCS and MMSE scores was fair, with Pearson's $r=0.61$ (95% CI, 0.56–0.66). *Conclusions:* The QCS can be administered more quickly than the MMSE, and is easier to administer in the ED because it does not require the subject to read, write or draw. There is a fair correlation between QCS and MMSE scores.

Keywords Mini-Mental State Examination • Cognitive testing • Emergency department

T.O. Stair • J. Morrissey • I. Jaradeh • T.X. Zhou
J.N. Goldstein
Department of Emergency Medicine
Brigham and Women's Hospital
and the Division of Emergency Medicine
Harvard Medical School, Boston, MA, USA

T.O. Stair (✉)
Department of Emergency Medicine
Brigham & Women's Hospital
75 Francis St, Boston, MA 02115, USA
e-mail: tstair@partners.org

Introduction

The Quick Confusion Scale (QCS) has been proposed as an assessment tool that is more appropriate in the emergency department (ED) setting than the standard Mini-Mental State Examination (MMSE) because it does not require that the examiner have any testing materials or that the patient be able to write and draw. The QCS also takes about half as long to administer as the MMSE [1].

The QCS has been validated in two trials at one institution. The original validation of the QCS was performed in 205 patients in one ED and excluded patients with less than 8 years of education, age less than 55 years or who did not speak English [2]. The second validation study included 295 patients at the same site, who had scored less than the maximum on the QCS, and then followed with the MMSE [3]. The first study calculated a correlation of $r=0.783$. The second study did not report a correlation coefficient, but did report an internal consistency of 64% and some demographic effects (patients with more education received higher scores, and older patients received lower scores).

In order to further validate the use of this more convenient scale, we have compared it against the MMSE in a larger patient population at another site. We used much broader inclusion criteria, and eliminated any learning effect that might give a higher score on the second test administered. In addition, we used a larger group of research assistants who had received less training than in the previous studies, in order to determine whether the test could be administered with minimal training.

Methods

Study design

This was a prospective comparison of the QCS and the MMSE on a convenience sample of ED patients and visitors over the age of 18. Between June 2002 and October 2003, during prespecified shifts (usually daytime hours), volunteer research assistants approached those who appeared to meet the inclusion criteria, obtained verbal consent and administered both tests. The QCS was translated into Spanish. Inclusion criteria were age greater than 18 years, ability to speak English or Spanish, and ability to answer questions. All aspects of the study were approved by the hospital's Internal Review Board (IRB).

Study setting and population

This was an urban teaching hospital ED with an annual census of 55 000.

Study protocol

Each research assistant underwent a brief training session, including practice sessions with the script and with the tests. Trained research assistants approached potential subjects and read from the following script: "We would like you to help us with a research study. The purpose of this study is to develop a scale to measure a patient's level of mental status or confusion. We hope to develop a short series of standard questions that should improve our diagnosis and treatment. If you agree to participate, I will ask you twenty questions. It should take less than fifteen minutes, and will not interfere with your medical care. May I continue?"

The first question was "About how many years of school have you completed?" The research assistant then flipped a coin to decide whether to administer the MMSE first (heads) or the QCS first (tails). How long both tests took to complete was also recorded. In addition, basic demographics were captured.

The QCS (and its scoring) can be summarised in seven questions:

- What year is it now? (2 points)
- What month is it? (2 points)
- Repeat this phrase after me and remember it: "John Brown, 42 Market Street, New York."
- About what time is it? (2 points)
- Count backwards from 20 to 1. (2 points)
- Say the months in reverse. (2 points)
- Repeat the memory phrase. (5 points)

Data analysis

Data sheets completed by research assistants were entered into an Excel spreadsheet. Statistical analyses are described in the results and were performed with Stata software (Stata Corp, College Station, TX).

Results

During the study period, approximately 1000 subjects were approached and 697 consented. Thirty-one subjects (31) did not complete both tests, usually because they were interrupted by necessary medical care. Nine did not complete the MMSE because they could not use their hands to write the sentence or draw the picture. Four did not complete the MMSE because they could not see well enough to read the sentence. Two took only the QCS in Spanish. These patients were excluded, leaving 684 for analysis.

Table 1 shows the demographics of this population. The mean age was 48±18 years, and 50% of subjects had completed high school. Years of education was defined as the number of years following first grade through completion of high school (typically 8 years for elementary school, 12 years for high school).

As previously shown [1], the QCS required less time to complete than the MMSE (2.7±1.3 *vs*. 5.1±1.6 min, $p<0.001$ by *t*-test). While patients with more education completed the MMSE more quickly (6 fewer seconds for each additional year of education, $p<0.0001$ by linear regression), this effect was not significant for the QCS (3.6 fewer seconds for each year, $p<0.07$ by linear regression).

The distribution of QCS *vs*. MMSE scores for the 666 subjects who completed both tests is shown in Figure 1. The Pearson product moment correlation coefficient was 0.61 (95% CI, 0.56–0.66).

We did not see a learning effect insofar as subjects on average did not score better on the second test. QCS scores averaged 13.2±2.1 when given first and 12.9±2.3 when given second ($p=0.3$, *t*-test). MMSE scores averaged 27.1±3.5 when given first and 27.5±2.7 when given second ($p=0.9$, *t*-test). After multivariable linear regression controlling for age, gender, educational level and hours in the ED before testing, MMSE and QCS scores were significantly correlated ($p<0.0001$).

It has been suggested that an MMSE score of 23 or a QCS score of 11 may represent clinically significant cognitive impairment [3]. Using MMSE=23 and QCS=11 as cutoff scores and MMSE as the gold standard, the QCS had a sensitivity of 64% and a specificity of 85% for detecting cognitive impairment. For patients >55, the sensitivity was 64% and specificity 82%. For those with >8 years of education, the sensitivity was 59% and specificity 86%.

Discussion

We have found that the QCS is a valid and more rapidly administered alternative to the MMSE in the ED. While a

Table 1 Subject demographics

	Mean±SD
Age (years)	48±18
Male gender	44%
Years of education	11±1.4
Hours in the ED prior to testing	4.1±5.4

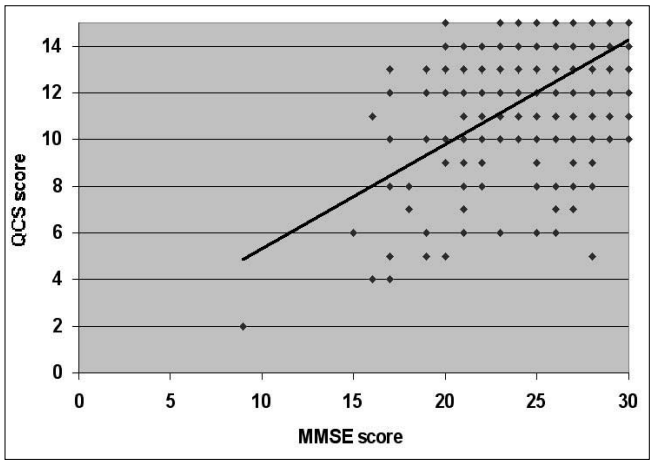

Fig. 1 Scatterplot of QCS score *vs*. MMSE score with trendline

time difference of 2.4 min may appear small at first glance, it is a clinically relevant difference to the busy emergency practitioner who must see many patients in a short period of time. In addition, patients who are unable to complete the MMSE due to functional impairment can still be evaluated with the QCS. The QCS may therefore be more readily adaptable on a large scale in the ED.

It is notable that our correlation coefficient was lower than in Huff's original validation study. One explanation is that only those over the age of 55 years with over 8 years of education were included in that study [2]. It may be that the two scales are more weakly correlated in younger subjects with less education. When we analysed only those over 55 with more than 8 years of education, then our coefficient was higher (r=0.66).

While the sensitivity of the QCS for detecting cognitive impairment (as defined by MMSE score) was somewhat low, the specificity was relatively high at 85%. Its strength appears to lie mostly in defining true cognitive deficits rather than as a screening tool for potential deficits.

Our study does have some limitations. As we used a convenience sample, rather than consecutive subjects, it is possible that there is confounding by time of day or day of week. A moderate number of patients (14%) had perfect scores on both QCS and MMSE, which may have skewed the correlation analysis. In addition, research assistants timed themselves and were not blinded to which test was administered, potentially introducing a source of bias. Test order can also be a source of bias, although we attempted to control for this by changing the order in which the tests were given. Finally, as a single-centre study, it is possible that our population is not representative of the general population.

In conclusion, the QCS has now been validated in an independent ED. It can be administered more quickly than the MMSE, and is easier to administer because it does not require the subject to read, write or draw. The QCS is an easy and valid alternative to the MMSE for use in cognitive assessment.

References

1. Folstein MF, Folstein SE, McHugh PR (1975) "Mini-Mental State": a practical method for grading the cognitive state of patients for the clinician. J Psych Res 12:189–198
2. Huff JS, Farace E, Brady WJ et al (2001) The Quick Confusion Scale in the ED: comparison with the Mini-Mental State Examination. Am J Emerg Med 19:461–464
3. Irons MJ, Farace E, Brady WJ et al (2002) Mental status screening of emergency department patients: normative study of the quick confusion scale. Acad Emerg Med 9:989–994