BRIEF REPORT

Graphical Instructions for Administration and Scoring the Mini-Cog: Results of a Randomized Clinical Trial

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OBJECTIVES: To develop a novel set of graphical Mini-Cog instructions designed to aid clinicians previously untrained on the Mini-Cog in accurate administration and scoring and to determine whether use of these graphical instructions improved the speed and accuracy of deployment of this tool.

DESIGN: Randomized clinical trial.

SETTING: Testing was conducted in a simulated environment with a mock patient.

PARTICIPANTS: Registered nurses working in inpatient or outpatient settings at a large academic medical center who had no prior exposure to or training with the Mini-Cog (N=92).

MEASUREMENTS: Our primary outcome was the composite proportion of nurses who made errors in administration or scoring of the Mini-Cog.

RESULTS: None of the nurses in the graphical instruction group and 28 (61%) in the standardized instructions group (15 (33%) made administration errors, 22 (48%) made scoring errors) made errors. Nurses randomly assigned to the graphical group were able to read (median 36 vs 54 seconds, P<.001), administer (46 vs 62 seconds, P<.001), and score (15 vs 84 seconds, P<.001) the Mini-Cog more quickly than those in the standardized instructions group.

CONCLUSION: Graphical instructions increase the accuracy and speed of test administration in nurses without prior training in Mini-Cog administration. Further research is necessary to confirm these findings and evaluate the use of this method in other healthcare professionals and settings. **J Am Geriatr Soc 2018.**

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Key words: Mini-Cog; administration; scoring; instructions

The Mini-Cog is a short, validated tool for the assessment of cognitive impairment consisting of 3-word recall and a simple clock-drawing task.[1,2] When trained clinicians or research personnel administer it, it takes less than 3 minutes to complete, making it a potentially attractive tool for healthcare systems interested in population-wide screening for cognitive impairment.[3] Standardized instructions for administration and scoring of the Mini-Cog are publicly available on-line (http://www.alz.org/health-care-professionals/cognitive-tests-patient-assessment.asp) (Supplementary Figure S1) but require at least a brief in-person or video training (http://actonalz.com). To our knowledge, there are no published data about whether clinicians, specifically nurses, can use these instructions to administer and score the Mini-Cog accurately in practice settings.

Initial development of the Mini-Cog used brief oral instructions and a simple visual scoring algorithm to make administration and scoring simple for non-pecialists.[1] Physician user feedback led to translation of the visual algorithm into a 5-point scoring system.[4] Additional instructions and multiple word sets were later added for repeated use, and the tool was reformatted to increase reliability in randomized screening trials.[5] We previously implemented routine cognitive impairment screening by a cardiology nursing team using the Mini-Cog at the Cleveland Clinic.[2] Although the nurses received some training on using the standardized format, an internal review of our data showed an approximately 18% error rate in Mini-Cog scoring (unpublished data). We hypothesized that simplifying administration and scoring for nonspecialists could improve accuracy in application by clinicians unfamiliar with cognitive assessment. Based on this, we developed a novel Mini-Cog instructional tool designed to allow nurses, who have not been involved and are not experienced with
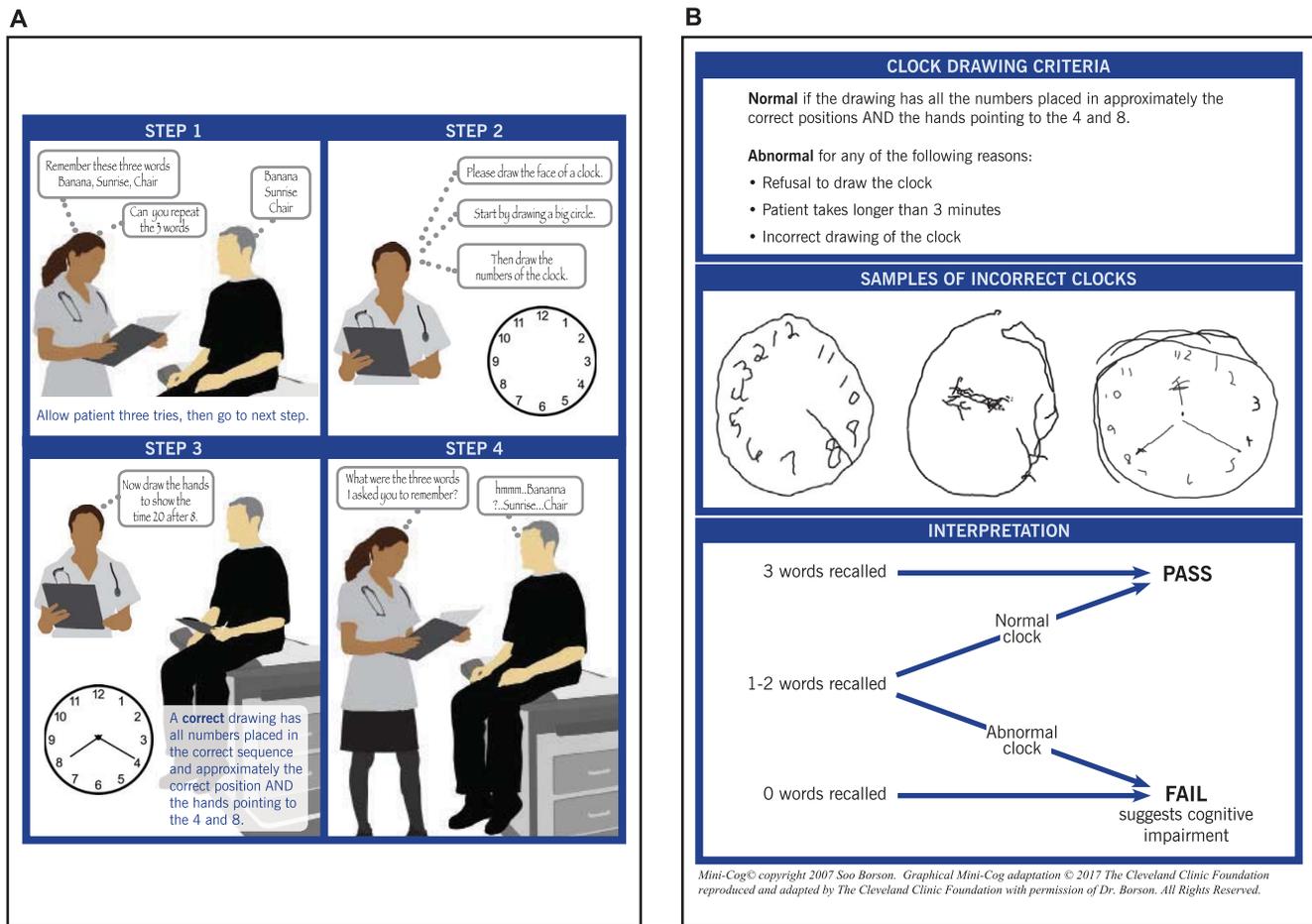
Figure 1. Graphical Mini-Cog instructions: (A) front and (B) back of card. [Color figure can be viewed at wileyonlinelibrary.com]

cognitive impairment screening using the Mini-Cog, to administer and score the test accurately. We compared their speed and accuracy using the graphical version with their speed and accuracy using the standardized version.

METHODS

Graphical Mini-Cog Instructions

We developed a novel set of Mini-Cog instructions to aid clinicians in appropriately administering and scoring the test in routine clinical practice. The intervention targeted clinicians unfamiliar with the Mini-Cog and cognitive assessment in general. The instructional tool (Figure 1) is double sided and designed to be printed on a 5- by 7-inch laminated card. The front is a 4-panel cartoon visually depicting how the test should be conducted. The back has 3 panels, the first detailing in sentence form the differences between normal and abnormal clock drawings, the second showing examples of incorrectly drawn clocks, and the third presenting a simple global grading algorithm for the Mini-Cog. The content and scoring rules are identical to those of the original 5-point Mini-Cog[4] and the standardized version. For simplicity the graphical instructions have one set of words ("banana", "sunrise", and "chair") rather than the six alternative sets used in the traditional Mini-Cog instructions (https://mini-cog.com, last accessed November 7, 2017).

Study Design

We conducted a prospective, randomized, controlled, single-center trial comparing the standardized Mini-Cog instructions (Supplementary Figure S1) the graphical Mini-Cog instructions (Figure 1) in a simulated session. Study subjects were enrolled between July and October 2016. The Cleveland Clinic institutional review board and Nursing Institute approved the study. Written informed consent was obtained from each nurse before study entry.

Study Participants

Professional registered nurses who had graduated from a nursing program, held a registered nursing license, and worked in an inpatient or outpatient setting at the Cleveland Clinic Main Campus were eligible to participate. Nurses were excluded if they had previously trained in administration of the Mini-Cog or other similar neurocognitive assessment tools.

Study Procedures

The study was performed in the hospital or in the outpatient clinic during nursing work shifts. After providing informed consent, nurses were randomized to one of the two study arms: standardized or graphical Mini-Cog

Table 1. Subject Characteristics According to Type of Mini-Cog Instructions

Characteristic	Graphical, n = 46)	Standardized, n = 46	P-Value
Age, median (range)	29 (22–62)	29 (22–58)	0.77
Female, n (%)	39 (85)	40 (87)	0.77
Inpatient work setting, n (%)	45 (98)	45 (98)	1.00
Number of years in nursing, median (interquartile range)	4 (2–8)	4 (2–8)	0.87
Previously trained to administer Mini-Cog, n (%)	0 (0)	0 (0)	1.00
Native English speaker, n (%)	43 (93)	43 (93)	1.00
Work shift, n (%)			0.81
Morning	15 (33)	13 (28)	
Afternoon	23 (50)	26 (57)	
Evening	3 (7)	4 (9)	
Night	5 (11)	3 (7)	
Shift phase, n (%)			0.65
Start	11 (24)	14 (30)	
Middle	30 (65)	29 (63)	
End	5 (11)	3 (7)	

instructions. We used a freely available online tool (https://www.sealedenvelope.com/simple-randomiser/v1/lists) to generate a blocked randomization list to ensure equal allocation of subjects. Three mock patients were used (author ET, LY, or BG). We asked nurses first to read their respective instructions (Task 1), then to administer the Mini-Cog to the mock patient based on their understanding of the instructions (Task 2), and finally to grade the Mini-Cog results using the instructions provided (Task 3). Nurses kept their instructions throughout the testing session and were allowed to refer back to them as needed. All mock patients produced the same pattern of partially correct word recall (2 of 3 words correct) and clock errors (Supplementary Figure S2). Using a stopwatch, we timed how long each nurse took to complete each task. Finally, we assessed the administration portion (Task 2) and the scoring portion (Task 3) as correct or incorrect. We kept track of the types of errors observed at each step of the administration and scoring processes.

Study outcomes

The primary outcome was the composite proportion of nurses who failed to administer or score the Mini-Cog correctly. The secondary outcomes were the individual components of the primary outcome, including failure to administer the Mini-Cog correctly and failure to score it correctly. An additional secondary outcome was the time required to complete each of the tasks (reading, administration, scoring).

Statistical Analyses

We calculated sample size based on an anticipated Mini-Cog scoring error rate of 18% in the standardized instructions arm and an anticipated 1% in the graphical instructions arm (a 94% relative difference), we calculated that a sample size of 92 nurses would be required to detect a difference between study groups with 80% power at a two-sided .05 significance level.

We calculated differences between the two study arms with respect to the binary outcomes using the chi-square test and with respect to the continuous outcomes (e.g., time to complete each task) using a t-test. We summarized data about how long it took to complete each task graphically with means and 95% bootstrapped confidence of the mean using 100 bootstrap samples of the data.

We stored data in a secure RedCap (www.projectredcap.org) database and analyzed it using R version 3.2.3 (www.r-project.org).

RESULTS

Study Population

Of 94 nurses who considered participation, 92 consented and subsequently underwent randomization, 46 to the standardized instructions arm and 46 to the graphical arm. Table 1 shows participant characteristics. There were no significant differences between the groups. Participants tended to be young (median age 29) women, relatively early in their careers (median number of years in nursing 4), working in inpatient settings. A large majority were native English speakers. None had prior exposure to the Mini-Cog.

Study Outcomes

The number of nurses who failed to administer or score the Mini-Cog correctly (composite primary outcome) was lower in the graphical Mini-Cog instructions group than in the standardized group (0% vs 61%, P<.001) (Table 2). Individual components of the primary outcomes were better in the graphical instructions group than the standardized instructions group as well, with a lower rate of incorrect administration (0% vs 33%, P<.001) and incorrect scoring (0% vs 48%, P<.001) (Table 2).

Nurses in the graphical instructions group were able to (Table 2, Supplementary Figure S3) read the instructions (median 36 vs 54 seconds; P<.001), administer (46 vs 62 seconds; P<.001), and score the test (15 vs 84 seconds; P<.001) more quickly than the standardized instructions group.

Errors in Administration Versus Scoring

We conducted a sensitivity analysis to determine whether the scoring portion was associated with errors independent

Table 2. Study Outcomes According to Type of Mini-Cog Instructions

Outcome	Graphical, n = 46	Standardized, n = 46	P-Value
Primary outcome: incorrect administration or scoring, n (%)	0 (0)	28 (61)	<.001
Secondary outcomes			
Incorrect administration, n (%)	0 (0)	15 (33)	<.001
Incorrect scoring, n (%)	0 (0)	22 (48)	<.001
Time to read, seconds, median (IQR)	36 (22–54)	54 (34–80)	<.001
Time to administer, seconds, median (IQR)	46 (35–60)	62 (45–89)	<.001
Time to score, seconds, median (IQR)	15 (10–26)	84 (53–110)	<.001

IQR = interquartile range.

of the administration portion. Of the 31 nurses in the standardized instructions group who administered the test correctly, 13 (42%) scored the test correctly. In the graphical instructions group, none of the 46 nurses who administered the test correctly made errors in scoring.

Types of Errors

All Mini-Cog administration and scoring errors occurred in the standardized Mini-Cog instructions group. We analyzed the first occurrence of any error and total errors in this group. Of the 28 nurses who failed to administer or score the Mini-Cog correctly, 15 made errors in the administration phase and 13 in the scoring phase independent of errors in administration (Supplementary Figure S4).

Our analysis showed that nurses made a total of 51 errors (Supplementary Figure S5). Nurses who administered or scored the test incorrectly made an average of 1.8 errors. The errors made, in order of frequency, were incorrect scoring as "pass" versus "fail" (n=20, 39% of errors), incorrect scoring of the clock (n=9, 18% of errors), failing to instruct to draw clock with hands (n=9, 18% of errors), failing to provide 3 words to remember (n=5, 10% of errors), failing to administer 3-word recall (n=4, 8% of errors), and failing to determine how many words were correctly recalled (n=4, 8% of errors).

DISCUSSION

In our study of nurses who were unfamiliar with cognitive impairment screening using the Mini-Cog, we found that use of a new graphical instructional tool eliminated failures in administration and scoring seen with the standardized instructional tool. We also found that nurses using this tool were able to complete testing more rapidly. Furthermore, we analyzed the types of errors made and found that errors in scoring the Mini-Cog results as a whole and specifically the clock portion were the most common errors made.

Our study and findings are important for several reasons. The publicly available standardized Mini-Cog instructions can be challenging for previously untrained nurses to use. In addition, use of that alternative set of instructions that we developed may allow these types of clinicians to more accurate administer and score the Mini-Cog.

In a recently published statement, the International Association of Gerontology and Geriatrics highlighted the importance of routine screening for cognitive impairment and emphasized that the first step involves training healthcare professionals on how to administer screening tools.[6] Training clinicians to conduct cognitive screening is time consuming and needs to be simplified or streamlined because the workforce is large. Healthcare systems interested in expanding nurse-conducted population-wide screening for cognitive impairment using the Mini-Cog should consider routinely using our graphical Mini-Cog instructions to improve administration and scoring accuracy and reduce time to complete.

Our study has several limitations. First, it was performed in a simulated environment with mock patients, each of whom was young and healthy and did not attempt to simulate the behavior of an older adult who may be cognitively impaired. It is unknown whether administration, scoring, and timing of the Mini-Cog using our graphical tool would yield similar results in practice with real patients, most of whom would be older individuals at risk of cognitive impairment by virtue of age or medical morbidity. Second, we enrolled only nurses, limiting generalizability of our findings to other types of healthcare providers. A previous study demonstrated that medical assistants can administer and score the Mini-Cog with high accuracy and reliability using simple instructions;[4] future work should evaluate whether individuals with no clinical training could accurately administer the Mini-Cog using our graphical tool, which could promote rapid expansion of screening for cognitive impairment. Finally, the lack of numerical scoring in the graphical Mini-Cog instructions may be a limitation for certain applications such as tracking in electronic medical records but was designed to facilitate rapid adoption in nonspecialist settings.

ACKNOWLEDGMENTS

final approval of manuscript. Gorodeski: study concept and design; analysis and interpretation of data; drafting, revision, final approval of manuscript.

Sponsor's Role: None.

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article.

Figure S1. Standardized instructions for administration and scoring of the Mini-Cog.

Figure S2. Incorrectly drawn clock used in trial with all nurses who instructed mock patients to draw a clock.

Figure S3. Comparison of times to read, administer, and score the Mini-Cog, by instructions used.

Figure S4. First occurrence of errors made in the standardized Mini-Cog instructions group.

Figure S5. Total errors made in the standardized Mini-Cog instructions group.