The Mini-Cog: a community screening tool for dementia in Indonesia

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Running Title: Mini-Cog: Dementia screening tool

Abstract

Background: Early detection of dementia enables more effective planning and can enable access to treatment and support. The Mini-Cog is a widely used screening instrument in Indonesia; however, this instrument has never undergone a translation and cultural adaptation process. Currently, there is no data on how accurate the tool is against diagnostic criteria, particularly in low-education.

Methods: Embedded within the community-based dementia prevalence study was the Strengthening Responses to Dementia in Developing Countries (STRiDE) project; older adults (aged ≥ 65 years) were randomly recruited from sites in Jakarta and North Sumatra, Indonesia. All participants were asked to complete the Mini-Cog and the 10/66 short dementia diagnostic

schedule. The accuracy of three Mini-Cog algorithms (Mini-Cog1, Mini-Cog2, and Mini-Cog3) were compared against and the 10/66 short dementia diagnostic schedule. Additional analysis explored its performance accuracy at different educational levels.

Results: The Mini-Cog test performance assessment was conducted on 2,098 older adults. The area under the curve (AUC) of Mini-Cog1, Mini-Cog2, and Mini-Cog3 receiver operator characteristic (ROC) curves were 0.66, 0.62, and 0.64, respectively. All algorithms demonstrated high sensitivity (Sv) but low specificity (Sp). (Mini-Cog1: Sv 83.2%; Sp 49.2%, Mini-Cog2: Sv 87.1%; Sp 37.8% and Mini-Cog3: Sv 72.5%; Sp 56%). All algorithms showed no affected by education. Only 59.1% of people without dementia could do the CDT.

Conclusions: The high sensitivity of the Mini-Cog1 algorithm lends itself to screening purposes. Given that the specificity is still low, and less than 60% of patients without dementia can complete the CDT. Further research is needed, as is the development of screening instruments with high accuracy values in low- and middle-income countries, particularly in Indonesia.

Keywords: Dementia, Mini-Cog, Older adults, screening tools

Background

The global challenge of rising numbers of people who live with dementia is well-recognized. Due to rapid population ageing, this phenomenon is particularly pronounced in low-income and middle-income countries (LMICs) such as Indonesia. Worldwide, there were approximately 50 million people living with dementia in 2015, and this is projected to increase to 152.8 million by 2050.[1] The increase will be particularly marked in LMICs, where approximately two-thirds of people with dementia already live. [2] In Indonesia, the number of people with dementia is expected to increase substantially from 1 million in 2019 to 3.4 million in 2050. [1] A health systems and services response is imperative to tackle the significant health and social consequences of the global dementia challenge. [2,3] Central to this response is a timely and accurate diagnosis, which informs and allows the identification of treatable and reversible forms of dementia, secondary prevention through reduced risk profiles, better management of cognitive and behavioural symptoms of dementia, and planning for future care needs and arrangements.[4]

Brief neuropsychological assessments of cognitive decline and dementia, including the Montreal Cognitive Assessment (MoCA), the Mini-Mental State Examination (MMSE), and the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE), have demonstrated validity and clinical utility to varying degrees.[5–10] However, they can be time-consuming, are not literacy- and education-fair, and training of interviewers is necessary for standardized and reliable measurements.[11–14] Given that 13.3% of older adults (aged > 50) in Indonesia are illiterate.[15] A screening tool must be validated to account for low education levels. Having such a tool would also facilitate dementia screening and diagnosis at the primary healthcare level, contributing to reducing likely diagnostic and care gaps.

The Mini-Cog is a neuropsychological test that is designed to detect mild cognitive impairment (MCI) and dementia.[16–19] The test consists of a clock drawing test (CDT) and a three-item memory test and takes about three minutes to complete. It has been reported that it is not significantly influenced by language, culture, and literacy and may be used with confidence also in individuals with low literacy levels.[20] While its accuracy varies according to region and interpretation method, it has been demonstrated to have a high sensitivity (Sv) and specificity (Sp) for identifying cognitive impairment.[18,21–23]

A study in Brazil's primary care setting in elderly with lower education showed the best performance of Mini-Cog, which was found at the cut-off point of 2/3, yielding Sv and Sp of 60% and 65%, respectively.[24], while other primary care studies showed the best cut point of the Mini-Cog was 1/2 (Sv; 0.60, Sp; 0.90).[25] In another review, Mini-Cog showed variations in Sv values between 0.76 to 1.00 while the Sp varied between 0.27 to 0.85 in a primary care setting,[23] 0.67, 0.60, 0.87 for Sv and 0.87,0.65, and 1.00 for Sp in a secondary care setting and high level of Sv (0.99, 0.76 and 0.99) and Sp (0.93, 0.89 and 0.83) in the community setting.[22]

In another review, Mini-Cog showed variations in Sv values between 0.76 to 1.00 while the Sp varied between 0.27 to 0.85 in a primary care setting,[23] 0.67, 0.60, 0.87 for Sv and 0.87,0.65, and 1.00 for Sp in a secondary care setting and high level of Sv (0.99, 0.76 and 0.99) and Sv (0.93, 0.89 and 0.83) in the community setting.[22]

Despite the Mini-Cog being adopted widely within academic and clinical settings in Indonesia, few studies have explored the performance of the Mini-Cog at the population level, with few exceptions in small (e.g. <100 subjects), and non-representative samples.[26–28]

The primary objective of this study was to assess the performance of the Mini-Cog in older adults to screen for dementia using various algorithmic cut-offs. The secondary objective was to determine the effect of educational attainment on the performance of these algorithms.

Materials and Methods

This study is part of the wider Strengthening Responses to Dementia in Developing Countries (STRiDE) programme,[29] it was to generate novel data on the prevalence, cost and impact of dementia in low- and middle-income countries to build better health policy. There are several low-middle-income countries that are members, including Indonesia and South Africa.[30]

Cross-cultural adaptation process of the Mini-Cog

We broadly followed the ISPOR Principles of Good Practice and the World Health Organization recommendations for the cross-cultural adaptation of patient report outcomes.[31] The details of this process have been discussed elsewhere.[32,33]

In the word choice of Mini-Cog, we use the words "Leader" or "Pemimpin" in Indonesian, "Season" or "Musim" in Indonesian and "Table" or "Meja" in Indonesian. In the aspect of word list recall, there are several words that need to be adjusted in the Indonesian version of Mini-Cog to avoid using two words in each item. For example, "sunrise" translates into "matahari terbit" in Indonesian, so we chose "pagi" (morning) instead. Likewise, the word "daughter" translates into "anak perempuan", and therefore we chose "anak" instead.

Diagnostic performance of Mini-Cog

The study of the diagnostic performance of Mini-Cog was collected between September and December 2021 in Jakarta and North Sumatera provinces, Indonesia. Within each province, districts and subdistricts were randomly selected, and then a register of older adults living in that locality was generated. Older adults were randomly selected from the list. Inclusion criteria: age ≥65 years, ability to communicate in Bahasa Indonesia, and availability of an informant (someone who knew the older adult well). There were no criteria related to cognitive impairment or diagnosis of dementia. Of the 2,216 subjects who were included, 106 had missing data and were excluded from the analytic sample. Further details of the setting, sampling strategy, and participants can be read elsewhere.[30]

Measures

Dementia diagnosis (the reference standard) - The 10/66 short dementia diagnostic schedule,[34] Upon which, the 10/66 short dementia diagnostic schedule is applied to identify cases of probable dementia. The Instruments composed of the Community Screening Instrument for Dementia (CSI-D) instrument,[35] the Consortium to Establish a Registry for Alzheimer's Disease (CERAD) instrument:10-word list learning task with delayed recall,[36] and the EURO-D instrument: a short, widely used, and validated of depressive symptoms.[37] The algorithm has good sensitivity and specificity across a wide range of settings [34,38–40]. Mini-Cog (the index test) - consists of a CDT and a three-item recall test. CDT was scored as 2 for a normal clock (or 0 for an abnormal clock), and the three-item recall was scored from 0 to 3. To identify screen-positive cases of dementia, we applied three different algorithms. We applied the previously developed Mini-Cog1 and Mini-Cog2 algorithms.[16,41] In both of which a recall a score of 3 is considered normal.[41], whilst lower recall scores can be differentiated by performance on the CDT. In addition, a third screening algorithm (herein referred to as Mini-Cog3) was applied to understand whether a lower and more sensitive threshold (recall of ≥ 2 considered normal) might be more appropriate for low-education groups. Kusalaruk et al. was validation of the two algorithms; the study found sensitivity and specificity of Mini-Cog 1 (Sv 66.7%; Sp 98.4%; ROC 82.5) and Mini-Cog 2 (Sv 72.8%, Sp 97.6%; ROC 85.2).[41] See Figure 1 for the different Mini-Cog screening algorithms applied. Researchers were asked to rate the confidence in data collected for the Mini-Cog (0 = reasonable to 5 = unable to collect the data). All instruments were in Bahasa.

Procedure

The older adult and informant were seen together in the community by a pair of researchers. Informed consent was obtained by all participants. In instances in which participants lacked the capacity to consent, a personal consultee shared the wishes of the older adult. Participants completed the questionnaires within the toolkit, including demographic information, the Mini-Cog and the 10/66 short dementia diagnostic schedule. The informant answered questions (e.g., the informant component of the CSI-D) separately from the older adult. The toolkit was consistently delivered in the same order within a single session (unless a break was requested), in which a 10/66 short dementia diagnostic schedule was not administered adjacent to the Mini-Cog. The researchers were blind to the outcome of the diagnostic algorithm and, therefore, were unable to distinguish cases of dementia based on the interviews alone. The screening thresholds for the Mini-Cog were applied only after all data were collected, independent of the

10/66 short dementia diagnostic schedule. All data were entered into a REDCap database via the REDCap Mobile app.[42,43]

Operational Definition

Dementia is characterized by a decrease in at least two domains of cognitive function or behaviour (neuropsychiatric) that interferes with functional activities and is not explained by a significant psychiatric disorder or delirium, obtained from the history of the patient or knowledgeable informants, along with an objective cognitive assessment.[44] Within STRiDE, we used the 10/66 short dementia diagnostic schedule to identify possible cases of dementia in the community, which was used as a reference standard of community-level dementia diagnosis to validate the index text based on the Mini-Cog assessment.

Statistical Analysis

Descriptive statistics were used for the demographic and Mini-Cog characteristics of the participants and are presented as percentage, mean, and standard deviation (SD). Discriminant validity was ascertained through a multiple regression model in which age, sex and level of education were controlled for. Odds ratios (ORs) were calculated to ascertain the impact of educational attainment on the performance of each component of the Mini-Cog (word recall and CDT).

The area under ROC curve analysis was used to compare the overall accuracy of each of the Mini-Cog algorithms for detecting dementia against the 10/66 short dementia diagnostic schedule. The classification of the AUC ROC score was as follows: AUC<0.5 was considered no discrimination, 0.6≥AUC>0.5 was considered poor discrimination, 0.7≥AUC>0.6 was considered acceptable discrimination, 0.9≥AUC>0.7 was considered excellent discrimination, and AUC>0.9 was considered outstanding discrimination.[45] Diagnostic accuracies were subsequently checked in low-education (≤6 years) and high-education (> six years) groups. Sensitivity, specificity and AUC were reported for the three Mini-Cog algorithms. Supplementary analysis was applied to the summative Mini-Cog score to identify whether an optimum cut-off could be identified using the AUC and Younden index (*J*). Subsequently, the effects of education on AUC were explored on the optimum threshold. All data analysis was performed using IBM SPSS Version 22.

Results

Participant Characteristics

Of the 2,110 participants with data that allowed running of the complete 10/66 short dementia diagnostic schedule, there were missing data for the Mini-Cog in twelve participants (n=2,098). Participants with missing Mini-Cog data did not differ from those with complete Mini-Cog data based on age (t=1.67, p=0.10), sex (χ^2=1.61, p=0.24), presence of sensory impairment (χ^2=0.23, p=0.78), and education level (χ^2=2.16, p=0.15).

Across the sample, 779 participants (37.1%) had less than elementary school education (≤6 years of education). Five hundred sixty participants (26.7%) were identified as having dementia according to the 10/66 short dementia diagnostic schedule. Age, sex, and level of education were all significantly associated with dementia caseness (p<0.01). Demographic data are presented in Table 1.

Mini-Cog properties

Across the valid cases, participants scored on average 2.2 (SD=1.69) on the Mini-Cog. Scores were near normally distributed, with a skewness of 0.22 (SE=0.05) and kurtosis of -1.06 (SE=0.11). A quarter of participants scored zero (n=527, 25.1%) on the Mini-Cog. Low education attainment (≤6 years of education) was significantly associated with reduced likelihood to accurately complete the CDT (OR = 0.23, 95% CIs = 0.19 to 0.28) and successful three-word recall (OR = 0.49, 95% CIs = 0.39 to 0.62).

Identified cases of dementia scored lower on the Mini-Cog when compared to non-cases (B = -1.4, 95%CI =-1.53 to -1.22). This relationship remained after controlling for age, sex and education attainment (B = -1.1, 95% CIs = -1.25 to -0.95, p<0.001).

Applying the three Mini-Cog algorithms revealed different percentages of participants screening positive for dementia: Mini-Cog1 (n=1,248; 59.5%), Mini-Cog2 (n=1,444; 68.8%), and Mini-Cog3 (n=1,083; 51.6%).

Researchers rated that the data collected from the Mini-Cog was classified as “reasonable” in 2,081 interviews (99.2%).

Dementia Screening Accuracy: Whole Sample

See Supplementary Tables 1, 2 and 3 for frequencies of screen positive and negative against the 10/66 short dementia diagnostic schedule. The sensitivity and specificity of the Mini-Cog algorithms against the 10/66 short dementia diagnostic schedule are presented in Table 2. The results of the analysis reveal that the three algorithms have good sensitivity values: Mini-Cog1 (83.2%), Mini-Cog2 (87.1%), and Mini-Cog3 (72.5%). Specificity across all algorithms was generally low: Mini-Cog1 (49.2%), Mini-Cog2 (37.8%) and Mini-Cog3 (56.0%). All three Mini-Cog algorithms had acceptable discrimination properties (0.7≥AUC>0.6).

Supplementary analysis revealed that adopting a threshold of ≤1 was the best-performing summative threshold (J=0.35). The threshold of ≤1 maintained acceptable discrimination properties (0.7≥AUC>0.6), though benefitted from having better specificity compared to the Mini-Cog algorithms applied (74.8%). See supplementary table 4.

Dementia Screening Accuracy: Split by education attainment

Only the Mini-Cog1 algorithm had acceptable discrimination across education groups (0.7≥AUC >0.6). See Table 3. Supplementary analysis of the summative threshold (≤1) demonstrated an equivalent acceptable discrimination across education groups (0.7≥AUC >0.6). See supplementary table 5 and supplementary figure 1.

Discussion

In Indonesia, there is no standardized screening tool for dementia used on a national scale, so identifying a tool that is practical and accurate is a priority. The Mini-Cog itself in Indonesia has been popularly used, but there are very few publications regarding its screening value.[26] This is the largest study of its kind within Indonesia, involving 2,098 older people. A key finding of this study is that the overall performances of the Mini-Cog algorithms (Mini-Cog1, Mini-Cog2, Mini-Cog3) in differentiating dementia from normal older adults are acceptable according to the AUCs of the ROC curve (AUC>0.60). In the present study, The Mini-Cog1 and Mini-Cog2 had sensitivity, specificity and AUC of Mini-Cog1 (Sv 83.2%; Sp 49.2%; AUC 0.66) and Mini-Cog2 (Sv 87.1%; Sp 37.8%; AUC 0.62). Our findings show sensitivity values tend to be high > 80% but low values were found for CDT performance and three word recall, especially in the non-dementia elderly population. Contrast with another study, the algorithms have found sensitivity and specificity of Mini-Cog 1 (Sv 57.4%; Sp 85.4%) and Mini-Cog 2 (Sv 69%; Sp 73.1%)[16] and Kusaluruk et al. reported Mini-Cog1 (Sv 66.7% ; Sp 98.4%) and Mini-Cog2 (Sv 72.8%; Sp 97.6%,).[41] Both algorithms had AUCs above 0.70, with the sensitivity of the tools ranging between 57.4% and 69%. The Mini-Cog2 is more appropriate than Mini-Cog1, in contrast to our study. The difference of results is likely due to the elderly population with lower literacy in the study population in Indonesia.

High sensitivity is generally considered important for screening, as it means the tool correctly identifies more cases. Notably, irrespective of the algorithm, our findings indicate that the Mini-Cog has low specificity and, thus, is susceptible to false positives. This is perhaps unsurprising because a quarter of participants were unable to correctly respond to any item of

the Mini-Cog, indicating floor effects; Indonesia has shown very low awareness of dementia, even among family caregivers with dementia.[46] Instruments with high sensitivity are very useful, especially in community groups with very low awareness of dementia. The Mini-Cog, irrespective of the algorithm applied, resulted in a screen positive in over 50% of participants, which ultimately may result in inefficiencies for use as a screening tool. It is important to remember that screening tools are not diagnostic instruments and that systems need to be in place to further assess screen positives to confirm the diagnosis, It is feared that the low specificity value in the elderly population with lower education will produce many false positive results so that further assessment is required, to avoid the possibility of misinterpretation which causes psychological harm to people who test positive for dementia, this can occur in populations with low literacy levels.

In several studies, the ability of the Mini-Cog to assess dementia had varying Sv and Sp values regardless of the different thresholds considered. Other review studies showed variations in Sv values from the lowest to the highest values. [22,23] In different settings, Pardo et al.'s study showed Sv and Sp of 0.60 and 0.90, with the best cut point being 1/2 point. [25] Filho et al.'s study on elderly people with less than five years of education, showed that the best performance was at the 2/3 cut point, which resulted in Sv and Sp of 60% and 65% respectively, [24] while our study in the community showed the best cut point was ≤1 Sv 60.5% and Sp 74.8%.

Few studies have evaluated the effect of education on the performance of the Mini-Cog, and the results have been inconsistent.[18,24,47] Our study compares AUC values split by educational attainment, in which the all of algorithm was found to have same performance against the 10/66 short dementia diagnostic schedule irrespective of education level, our findings support previous research in a Thai sample.[16] Another study reported that at lower levels of education (≤4 years), the Mini-Cog's Sv and Sp were consistently low regardless of the various cut-offs considered. The best-performing cut-off (2/3; the equivalent of the Mini-Cog1 algorithm) against DSM-IV criteria resulted in Sv (60%) and Sp (65%).[24] The CDT has been critiqued as it typically requires a basic level of education.[48] Our findings support the notion that the CDT is the component of the Mini-Cog that is most influenced by educational attainment. It is for this reason that modified versions of the Mini-Cog have recently been developed, replacing the CDT with other tasks, to facilitate use in illiterate individuals.[49] The Mini-Cog3 algorithm developed for the purposes of this study does not appear to improve the agreement over the Mini-Cog1 and Mini-Cog2 in the low-education

group. Supplementary analysis revealed that a summative threshold of ≤1 would be appropriate to screen for dementia both in low- and high-education groups in an Indonesian population.

The strength of this study is the large sample size with good ascertainment. The main limitation of this study is that the 10/66 short dementia diagnostic schedule was used as a means to identify potential dementia cases rather than a formal clinical diagnosis. As such, our findings are predicated on the assumption that the 10/66 short dementia diagnostic schedule is accurate. Previous research has indicated that the 10/66 short dementia diagnostic schedule has good validity against other diagnostic criteria.[40] However, the 10/66 short dementia diagnostic schedule may have similar properties to the full algorithm, being sensitive to detecting milder cases of the condition and demonstrating education bias in certain regions.[50] Within the current cohort, the 10/66 short dementia diagnostic schedule has demonstrated good concurrent validity against measures of functional and cognitive impairment (unpublished). It is important to recognize that whilst the 10/66 short dementia diagnostic schedule factors in depression morbidity, it does not comprehensively account for all morbidities that can influence cognitive symptoms. Similarly, both the 10/66 short dementia diagnostic schedule and Mini-Cog algorithms require memory impairment. Whilst amnestic dementia is more common than non-amnestic types, [51,52] it is important to consider how the Mini-Cog would perform against non-amnestic types and the latest DSM-5 criteria. The researcher notes that the person who administered the mini-Cog was the same person who administered the algorithm, which may add bias even if the researcher was unaware of the actual algorithmic 10/66 diagnosis. The main weakness is that the application of assessment was not blind to the diagnostic interview. However, the diagnostic interview was administered by lay interviewers who did not know the result of the diagnostic algorithm so it is “semi-blind”.

Conclusions

The Indonesian version of the Mini-Cog instrument could be used as a cognitive screening tool in Indonesian older adults. The short nature and high sensitivity of the Mini-Cog1 algorithm lend themselves to screening purposes, and the acceptable agreement, makes it a reasonable fit for use in Indonesia, where there are large groups with limited education. Future research should consider the appropriateness of the CDT within the Mini-Cog and whether an alternative cognitive task might be more educationally fair. Irrespective, caution should be taken during implementation as the tool within Indonesia as it is susceptible to high false positives. Seeing that the specificity is still low and less than 60% of people without dementia could do the CDT.

For further studies, it is important to develop various screening instruments that have high accuracy values in low-middle-income populations, especially in Indonesia.

Data availability statement

The data that support the findings of this study are available from the corresponding author, [YT], upon reasonable request.

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Conflict of interest disclosure

There are no conflicts of interest to declare.

Ethics approval statement

The Medical Ethics Committee of Atma Jaya Catholic University of Indonesia approved this study protocol under the number 01/12/KEP-FKIKUAJ/2020 and Faculty of Medicine Universitas Sumatra Utara number 862/KEP/USU/2020.

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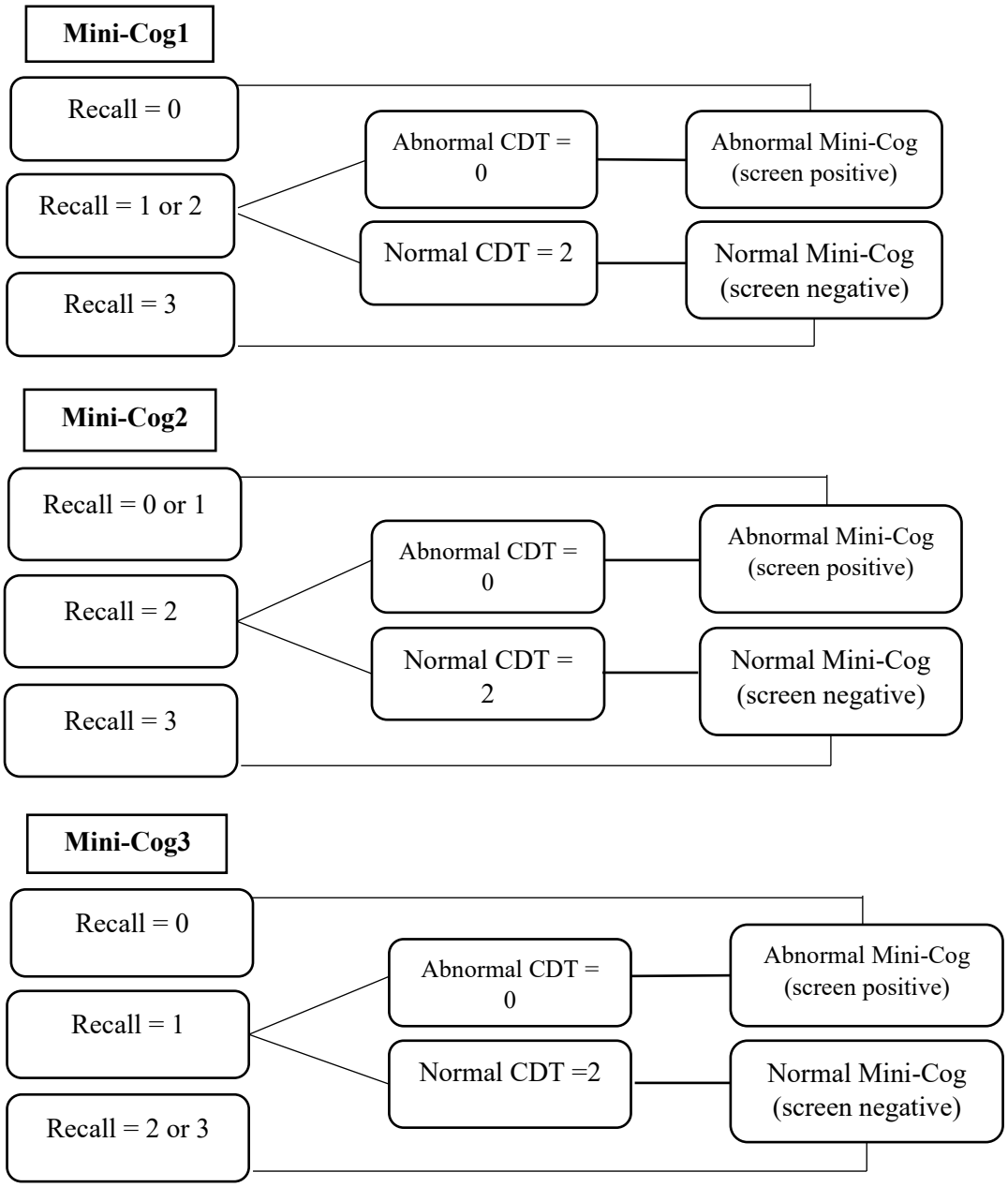


Figure 1. Scoring of the version of the Mini-Cog1, Mini-Cog2, Mini-Cog3. Adapted from Limpawattana et al., 2021[16] and Kusalaruk, 2012[41]

Table 1. Demographic and Mini-Cog characteristics of the participants with dementia (n=560) and without dementia (n=1,538) based on the 10/66 short dementia diagnostic schedule. Valid cases.

Variable	Dementia	No dementia
	M (SD)	M (SD)
Age	73.1 (6.32)	70.4 (4.89)
Mini-Cog index	1.2 (1.35)	2.5 (1.65)
	N (%)	N (%)
Recruitment Site		
Jakarta	291 (52.0%)	765 (49.7%)
North Sumatra	269 (48.0%)	773 (50.3%)
Sex		
Male	177 (31.6%)	669 (43.5%)
Female	383 (68.4%)	869 (56.5%)
Level of Education		
Not Attending School	139 (24.8%)	169 (11.0%)
Not completed elementary school	147 (26.3%)	324 (21.1%)
Completed Elementary school	171 (30.5%)	449 (29.2%)
Completed Junior high school	53 (9.5%)	245 (15.9%)
Completed Senior High School or more	41 (7.3%)	329 (21.4%)
Missing	9 (1.6%)	22 (1.4%)
Mini-Cog: Clock Drawing Task		
Normal (2)	118 (21.3%)	909 (59.1%)
Unable/Refused (0)	442 (78.9%)	629 (40.9%)
Mini-Cog: Word Recall		
Accurate Word Recall (3)	59 (10.5%)	421 (27.4%)
Accurate Word Recall (2)	73 (13.0%)	266 (17.3%)
Accurate Word Recall (1)	91 (16.3%)	304 (19.8%)
Accurate Word Recall (0)	337 (60.2%)	547 (35.6%)

570

571

Table 2. Comparison of the overall performance of the Mini-Cog1, Mini-Cog2 and Mini-Cog3 algorithms against the 10/66 short dementia diagnostic schedule.

Test*	Sensitivity	Specificity	AUC of ROC curve	95% CIs	P-value
Mini-Cog1	83.2%	49.2%	0.66	0.64-0.69	<0.001
Mini-Cog2	87.1%	37.8%	0.62	0.60-0.65	<0.001
Mini-Cog3	72.5%	56.0%	0.64	0.62-0.67	<0.001

*The threshold refers to figure

Table 3. Comparison of the overall performance of Mini-Cog1, Mini-Cog2, and Mini-Cog3 algorithms against the 10/66 short dementia diagnostic schedule, split by education level.

Test	AUC (95% CI)	
	≤6 years AUC (95% CIs)	>6 years AUC (95% CIs)
Mini-Cog1	0.62 (0.58-0.66)	0.66 (0.63-0.70)
Mini-Cog2	0.60 (0.56-0.64)	0.62 (0.59-0.66)
Mini-Cog3	0.60 (0.56-0.64)	0.64 (0.60-0.68)

Supplementary File

Supplementary Table 1. Frequencies of screening outcome (Mini-Cog1 algorithm) against diagnostic outcome (10/66 short algorithm)

	Dementia Free	Dementia	Total
Mini-Cog1: Screen negative	756	94	850
Mini-cog1: Screen positive	782	466	1248
Total	1538	560	2098

Supplementary Table 2. Frequencies of screening outcome (Mini-Cog2 algorithm) against diagnostic outcome (10/66 short algorithm)

	Dementia Free	Dementia	Total
Mini-cog2: Screen negative	582	72	654
Mini-cog2: Screen positive	956	488	1444
Total	1538	560	2098

Supplementary Table 3. Frequencies of screening outcome (Mini-Cog3 algorithm) against diagnostic outcome (10/66 short algorithm)

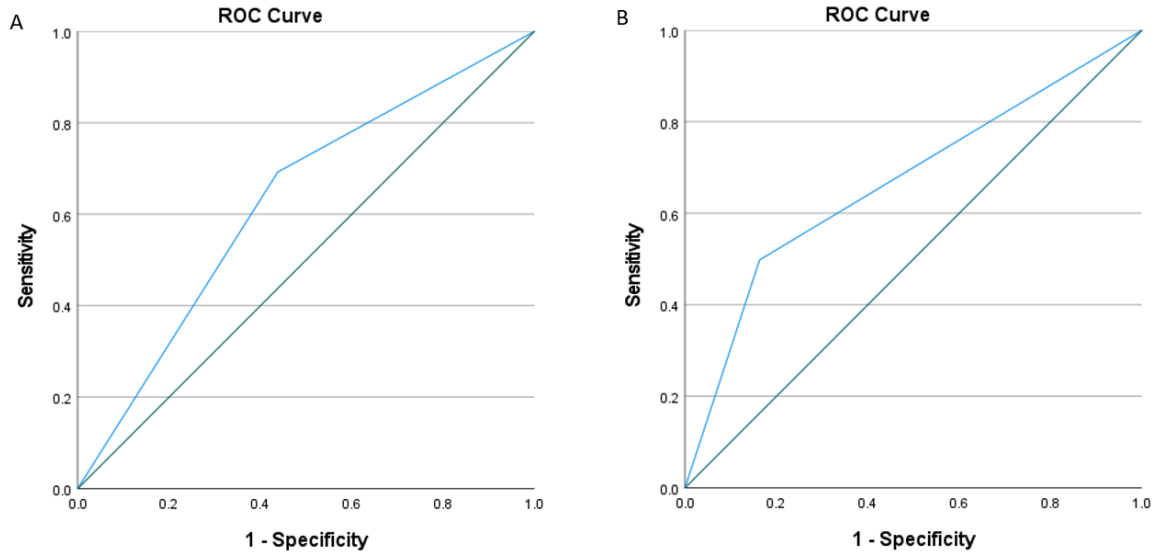
	Dementia Free	Dementia	Total
Mini-cog3: Screen negative	861	154	1015
Mini-cog3: Screen positive	677	406	1083
Total	1538	560	2098

Supplementary Table 4. Sensitivity, specificity and agreement statistics (AUC and Youden Index) for Mini-Cog1 adopting summative thresholds.

	Sensitivity	Specificity	AUC	95% CIs	Youden index (*J*)
Mini-Cog ≤ 0	48.2%	83.3%	0.66	0.63-0.69	0.32
Mini-Cog ≤ 1	60.5%	74.8%	0.68	0.65-0.70	0.35
Mini-Cog ≤ 2	83.2%	49.2%	0.66	0.64-0.69	0.32
Mini-Cog ≤ 3	94.8%	28.9%	0.62	0.59-0.64	0.24
Mini-Cog ≤ 4	97.1%	18.5%	0.58	0.55-0.60	0.16

Supplementary Table 5. Comparison of the optimum threshold for summative scores (≤1) against the 10/66 short algorithm, split by education level for Mini-Cog1.

	≤6 years AUC (95% CIs)	>6 years AUC (95% CIs)
Mini-Cog optimum threshold (≤1)	0.63 (0.59-0.67)	0.67 (0.63-0.71)



Supplementary Figure 1. Receiver Operating Characteristic Curve (ROC) curve for Mini-Cog threshold (≤1) in participants with; A) ≤6 years of education, and B) >6 years of education.