

Arabic intensive care delirium screening checklist's validity and reliability: A multicenter study



Nada S. Al-Qadheeb, PharmD, FCCM^{a,*}, Lama H. Nazer, PharmD, FCCM^b, Tharwat M. Aisa, MD^c, Hassan O. Osman, MD^a, Asia S. Rugaan, MD^c, Ahmad S. Alzahrani, MD^d, Iyad M. Ghonimat, RN^e, Alaaldin M. Mohammed, MD^a, Khalid Maghrabi, MD, FCCP^f, Abdullellah A. Alrowaished, MD^g, Najah H. Hussein, RN^e, Yahya A. Maslamani, MD^f, Sawsan Falatah, RN^h, Yoanna Skrobik, MD, FRCP(c) MSc, FCCMⁱ

^a Department of Critical Care, Hafer Albatin Central Hospital, Hafer Albatin, Saudi Arabia

^b Department of Pharmacy, King Hussein Cancer Center, Amman, Jordan

^c Department of Critical Care, King Abdullah Medical City, Makkah, Saudi Arabia

^d Department of Psychiatry, King Abdullah Medical City, Makkah, Saudi Arabia

^e Department of Nursing, King Hussein Cancer Center, Amman, Jordan

^f Department of Critical Care, King Faisal Specialist Hospital & Research Center, Riyadh, Saudi Arabia

^g Department of Psychiatry, King Faisal Specialist Hospital & Research Center, Riyadh, Saudi Arabia

^h Department of Nursing, King Faisal Specialist Hospital & Research Center, Riyadh, Saudi Arabia

ⁱ McGill University, Department of Medicine, Regroupement de Soins Critiques Respiratoires, Réseau de Santé Respiratoire FRQS, Montreal, QC, Canada

ARTICLE INFO

Available online xxxx

Keywords:

Delirium
Intensive care unit
Delirium screening checklist
Arabic
Reliability
Validity

ABSTRACT

Purpose: To develop an Arabic version of Intensive Care Delirium Screening Checklist (ICDSC) and assess its validity and reliability among critically ill patients.

Materials and methods: Multicentered study of convenience sample of adult ICU patients. Arabic translation was performed with rigorous back-to-back translation methods. Concurrent validity was established by calculating the sensitivity and specificity of two examiner assessments compared to a psychiatric evaluation. Kappa coefficients describe interrater reliability, whereas Cronbach α and composite reliability depict internal consistency. **Results:** Three hundred critically ill patients were enrolled. Of these, validity testing was assessed in 180 patients. ICDSC screening was positive for delirium in 11% of enrolled patients. The area under the receiver operator characteristic (ROC) curve is 0.9413, with predicted sensitivity 70% (95% confidence interval [CI]: 60–81%) and specificity 99% (95% CI: 98–100%). The Arabic ICDSC showed acceptable internal consistency (Cronbach α = 0.63 and composite reliability = 0.64). Interrater agreement was excellent (Kappa coefficient [κ] = 0.85).

Conclusions: Arabic ICDSC is a valid and reliable delirium-screening tool among Arabic-speaking ICU population. Future studies could address whether these findings are generalizable to a higher proportion of mechanically ventilated patients, and address acceptability and reliability in other Arabic language critical care settings.

© 2019 Elsevier Inc. All rights reserved.

1. Introduction

Intensive care unit (ICU) delirium usually manifests as an acute and fluctuating disturbance in attention, awareness and cognition [1]. Studies describe ICU delirium incidence rates of 30% to 50% and a prevalence rate of up to 80% [2–5].

* Corresponding author at: Department of Critical Care, Hafer Albatin Central Hospital, King Abdulaziz Road, Hafer Albatin 31991, Saudi Arabia.

E-mail address: nada.qadheeb@kfsh.med.sa (N.S. Al-Qadheeb).

¹ Permanent address: King Fahad Specialist Hospital, P.O.Box 15215, Dammam 31444, KSA Phone: +966-505293415, Fax: +966138426251, nada.qadheeb@kfsh.med.sa

Moreover, delirium is increasingly known to be associated with prolonged duration of mechanical ventilation, increased hospital and ICU length of stay, higher treatment cost, increased morbidity and mortality and is known to inflict long-term consequences for patients including functional impairment and cognitive disabilities requiring hospitalization [2,4–10].

Despite its clinical significance and the endorsement by the Society of Critical Care Medicine for routine ICU delirium monitoring using either the Confusion Assessment Method for the ICU (CAM-ICU) or the Intensive Care Delirium Screening Checklist (ICDSC), delirium remains underdiagnosed and monitoring tends to be sporadic and inconsistent worldwide [11–18]. A recent survey involving worldwide intensivists demonstrated that 30% of respondents do not routinely

monitor for delirium and 58% do not use a validated screening tool [19]. The most frequent barriers to delirium screening include lack of medical support, complexity of screening tools and difficulty in evaluating intubated and sedated patients [20]. Nonetheless, the exact reasons for failing to perform routine delirium monitoring remain unclear [21].

Among Arabic speaking population, a recently published psychometric study in a tertiary care hospital in Saudi Arabia described a delirium incidence of 63% [22]. Such findings suggest that delirium is similarly common in Arabic-speaking ICU patients and emphasizes the need for delirium assessment tools in Arabic. While CAM-ICU has been translated into several languages including Arabic, German, Greek, Swedish and many more [22–33], the ICDSC translation has been validated in seven languages including Turkish, Japanese, Portuguese, Indian, Dutch, Swedish and Danish [34–40]. The validity and reliability of the Arabic version of ICDSC has not been investigated.

This study aimed to develop an Arabic version of ICDSC tool and to test its validity and reliability in two Middle-Eastern Arabic-speaking countries.

2. Materials and methods

2.1. Setting and study design

This prospective, multicenter cross-sectional study was conducted in four intensive care units in three Saudi Arabian and one Jordanian hospitals. Site A is a 200-bed secondary hospital with 19 medical and surgical ICU (MSICU) beds. Site B is a 1331-bed tertiary hospital with 53 MSICU beds. Site C is a 1500-bed tertiary hospital with 28 MSICU beds. Site D is a 170-bed tertiary hospital with 18 MSICU beds. All four ICUs are closed units integrating a well-established pain and sedation practice. Institutional Review Board approval was obtained for each participating center.

2.2. Participants

Consecutive patients admitted to any of the four medical and surgical ICUs from April 2018 to October 2018 were screened for enrollment. Adult patients 18 years or older were eligible if they were hospitalized in the ICU for at least 24 h and were deemed conscious by Sedation Agitation Scale [SAS] ≥ 3 or a Richmond Agitation-Sedation scale [RASS] ≥ -2 . Patients were excluded if they were comatose, non-Arabic speakers, had a condition that might preclude delirium evaluation [severe dementia, schizophrenia, Alzheimer's disease, severe encephalopathy] or are unwilling to participate (Supplementary material 1, Table 1). Informed consent was obtained from patients or their legally authorized representatives prior to study enrollment. To ensure feasibility of recruitment at each site, recruitment was tracked through a site-specific consort diagram. An 85% screening and attempted recruitment threshold of eligible patients was considered acceptable for study feasibility at each site.

2.3. Translation and cross-cultural adaptation process

The tool was originally developed and validated for delirium screening in mechanically and non-mechanically ventilated ICU patients and designed to evaluate level of consciousness, inattention, disorientation, hallucinations, psychomotor activity, speech or mood disturbance, sleep disturbance and fluctuation of symptoms. A cut-off score of >3 present items corroborated with a psychiatrist's clinical diagnosis of delirium [13].

Arabic translation of the original ICDSC tool was performed with a rigorous back-to-back translation method according to the recommendations of the International Society for Pharmacoeconomics and Outcomes Research task force for translation and cultural adaptation [41].

Two authors (TA and HO) independently translated the ICDSC scale from English to Arabic. The translated version was then given to a

Table 1
Baseline characteristics.

No. of patients (%)	300
Site A	60 (20)
Site B	90 (30)
Site C	90 (30)
Site D	60 (20)
Age, yrs (mean \pm SD)	52.2 \pm 16.7
Male, n (%)	148 (49.3)
Mechanical ventilation, n (%)	22 (7.3)
Days in ICU before enrollment (median)	2 (1–8)
Sedation Agitation Scale at the time of assessment	
RASS ^a (median)	0 (–1–0)
Riker-SAS ^b (median)	4 (3–4)
Location before hospitalization, n (%)	
Home with spouse	77 (25.7)
Home with other family members	217 (72.3)
Other	6 (2.0)
Location before ICU admission, n (%)	
Emergency department	135 (45)
Hospital ward	97 (32.3)
OR following elective surgery	42 (14)
OR following emergency surgery	6 (2.0)
ICU at outside hospital	135 (45)
Ward at outside hospital	3 (1.0)
Other	1 (0.3)
Admission diagnosis, n (%)	
Post-operative	70 (23.3)
Cardiac	15 (5.0)
Neuro	14 (4.7)
Gastrointestinal	18 (6.0)
Others	23 (7.7)
Respiratory	69 (23.1)
Sepsis	44 (14.7)
Cardiac	39 (13.0)
Cancer	23 (7.7)
Gastrointestinal	9 (3.0)
Neurologic	9 (3.0)
Renal	8 (2.7)
Diabetes	5 (1.7)
Trauma	5 (1.7)
Other	19 (6.4)

ICU = intensive care unit, OR = operating room, RASS = Richmond Agitation Sedation Scale, SAS = Sedation Agitation Scale.

^a n = 240.

^b n = 60.

bilingual ICU nurse blinded to the original English version of the ICDSC, to perform the back translation.

To examine unresolved translation issues, these two authors identified and resolved the inadequate expressions/concepts of the translation, as well as any discrepancies between the forward translation and the existing. Experts then reviewed the back-translation with an emphasis on conceptual and cultural equivalence rather than linguistic equivalence.

The translated scale was reviewed by 15 Arabic native speaker ICU nurses to ensure understandability and cultural relevance of the translation. Proofreading and final adjustments completed the final version of Arabic ICDSC's production.

2.4. Delirium assessment

Trained ICU nurses, physicians, and critical care pharmacists screened patients for delirium using the Arabic version of ICDSC (Supplementary material 2). A multi-faceted approach was utilized to train clinicians. Each investigator was instructed and trained on how to use the Arabic version of ICDSC through one-on-one teaching provided by the primary investigator at each site and through online materials to educate about delirium. An independent delirium expert was available for questions. Assessments at each of the four participating sites were carried out by two trained examiners independently. The paired ratings required that the two assessments are performed within one hour. A psychiatrist validated the presence/absence of delirium within two

hours of the two examiners performing independent Arabic ICDSC evaluations in two Saudi hospitals based on DSM-IV (Diagnostic and Statistical Manual of mental disorders, fourth edition) [42] criteria. The raters' examinations were administered with each result blinded from the other and the obtained results, in turn, were blinded to psychiatric assessment. All assessment records were kept separately to further ensure blinding.

2.5. Statistical analysis

All statistical analyses were performed using SPSS version 19 (SPSS Inc., Chicago, IL, USA) and Statistical Analysis Solutions (SAS) version 9.4 (SAS Institute Inc., Cary, NC). ICDSC validity was measured by calculating the sensitivity, specificity, positive and negative predictive values of examiners in two Saudi Arabian tertiary hospitals in comparison with the psychiatrist clinical evaluation using the DSM-IV-TR. Interrater reliability was evaluated as the agreement between raters with Kappa coefficient. Moreover, internal consistency was described using the Cronbach α statistic and composite reliability. Based on sensitivity and specificity of 90%, an assumed delirium prevalence of 21%, precision of 8% and a 95% confidence interval (CI), the minimum sample size of this study was calculated to be 262 patients.

3. Results

A total of 651 patients were evaluated and 300 patients were enrolled in the study (Fig. 1). Descriptive statistics of study participants are displayed in Table 1. The mean age was 52 ± 17 years; 49% were males. Reasons for admission to the ICU were primarily post-operative cases, respiratory disease and sepsis.

3.1. Validity

Validation of the Arabic version of ICDSC was performed at two Saudi Arabian tertiary hospitals. Two independent examiners and a psychiatrist evaluated a total of 180 patients; 37 (21%) patients were diagnosed with delirium based on DSM-IV criteria and 30 (17%) patients screened positive for delirium based on the Arabic ICDSC assessment (Table 2). The remaining two sites were not able to perform validation as no psychiatrist was available. Overall, 32 (11%) patients from the four sites screened positive for delirium based on the Arabic ICDSC assessment.

The ROC curve with its area under the curve of 0.9413 is shown in Fig. 2. In keeping with the original scale validation, an overall sensitivity of 70% (95% CI: 60–81%) and a specificity of 99% (95% CI: 98–100%) was

Table 2

Overall results of the Arabic intensive care delirium screening checklist compared with psychiatrist assessment.

Psychiatrist assessment	ICDSC score ≥ 4	ICDSC score < 4	Total
Yes	29	8	37
No	1	142	143
Total	30	150	180

ICDSC = intensive care delirium screening checklist, Numbers represent individual patients.

demonstrated at ICDSC cutoff score of ≥ 4 . Furthermore, subgroup analysis of the examiners assessments at the two sites using the Arabic ICDSC showed sensitivity ranging from 45% to 100% and specificity ranging from 97% to 100% (Supplementary material 1, Table 2).

3.2. Reliability

We assessed the level of agreement between assessments with the Arabic ICDSC by calculating interrater reliability (Kappa coefficient [κ]). A total of 300 paired assessments were performed at the four participating sites. Significant and substantial agreement between raters was determined with an overall κ of 0.85. The individual ICDSC item was also completed demonstrating good to excellent concordances (Table 3). Moreover, interrater reliability of ICDSC scores between examiners at the four participating centers was strong with Kappa coefficient ranging from 0.66 to 1.0 (Supplementary material 1, Table 3). Finally, the Arabic ICDSC demonstrated acceptable internal consistency with Cronbach $\alpha = 0.63$ and composite reliability of 0.64. However, Cronbach α improved to 0.70, if item 7 (sleep/wake cycle disturbance) was removed. Item 2 (inattention) contributed the most to the reliability of the Arabic ICDSC.

4. Discussion

In this multicenter, cross-sectional study, we successfully developed an Arabic version of ICDSC and demonstrated an acceptable validity and

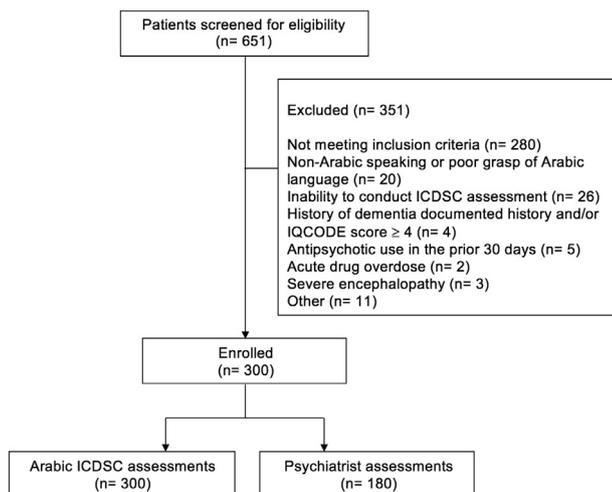


Fig. 1. Study flow chart. ICDSC = intensive care delirium screening checklist, IQCODE = informant questionnaire on cognitive decline in the elderly.

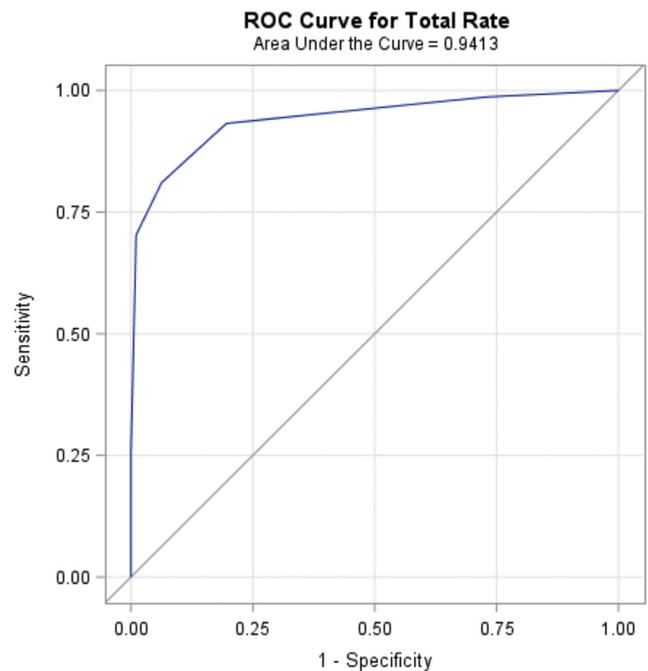


Fig. 2. Receiver operating characteristic (ROC) curve based on total score (0–8) on the day delirium is diagnosed. With a cut-off score of 4, levels of sensitivity and specificity estimated from the ROC curve yield 70% and 99%, respectively.

Table 3
Inter-rater reliability of the Arabic intensive care delirium screening checklist.

ICDSC domain	κ	95% CI
Altered level of consciousness	0.566	0.125–1.000
Inattention	0.834	0.735–0.933
Disorientation	0.823	0.725–0.921
Hallucination/delusion	0.805	0.694–0.916
Psychomotor agitation	0.869	0.768–0.970
Inappropriate speech or mood	0.819	0.698–0.940
Sleep/wake cycle disturbance	0.755	0.679–0.831
Symptom fluctuation	0.745	0.636–0.854
Overall ($n = 300$)	0.852	0.753–0.951

ICDSC = intensive care delirium screening checklist, κ = kappa coefficient.
CI = confidence interval.

reliability in detecting delirium among critically ill Arabic speaking population.

ICU physicians, nurses and pharmacists assessed patients for delirium using the Arabic ICDSC. Of these assessments, 50% were compared with psychiatrist clinical evaluation using DSM-IV-TR to determine the concurrent validity of the tool. Previous studies have reported that delirium occurs in up to 80% of patients in acute care setting and 10% to 80% in critically ill patients [43–46]. In this study, the psychiatrist clinical evaluation identified delirium in 21% of critically ill patients. This suggests that delirium is similarly common among critically ill Arabic-speaking population and highlights the continuous need for a reliable and valid tool to assess for delirium in this population.

The overall sensitivity and specificity of the Arabic ICDSC, 70% and 99%, respectively is consistent with previous studies suggesting sensitivity and specificity of the ICDSC ranging from 64 to 99% and 61–88%, respectively (Supplementary material 1, Table 4) [13,35,37,38]. Our results show inter-rater variability. High specificity values (97%, 98%, 100% and 100%) were achieved from all four examiners, while remarkable difference in sensitivity were noted, 45%, 59%, 93%, and 100%, respectively. These findings are similar to those by Van Eijk et al. where ICU physicians showed higher specificity (96%) than sensitivity (29%) [38]. Such results might be due to lack of experience in detecting delirium which reinforce the need for a more effective structured training program and extensive training methods to demonstrate higher agreement with expert raters; such programs improve ICU physicians' and nurse's ability to detect delirium with the ICDSC [47].

The interrater reliability of Arabic ICDSC between examiners in all four ICU settings was good to excellent for each individual component of the tool, as well as the overall score κ 0.85. These results are consistent with earlier studies, where the ICDSC also demonstrated moderate to high interrater reliability with κ of 0.7 [13,34,37]. This might be related to the fact that all examiners had a comprehensive understanding of ICU delirium. As for the item correlation, Cronbach's alpha of 0.63 is considered an acceptable internal consistency. Each of the eight ICDSC items is highly distinct and discriminating for the diagnosis of delirium [48]. Subgroup analysis for examiner's assessment from all participating centers showed acceptable to excellent interrater reliability with Kappa coefficient ranging from 0.66 to 1.0. However, the correlation for four ICDSC items in one of the sites, namely inattention, disorientation, psychomotor agitation and sleep/wake cycle disturbance was noted to be slightly lower. This variation may be related to differences in individual clinicians' level of expertise.

Our study has several strengths. It is the first to assess the validity and reliability of the Arabic ICDSC as a delirium assessment tool for Arabic critically ill patients, and was performed as a multicenter evaluation in two Middle Eastern countries. The original ICDSC Arabic translation considered the local cultural and linguistic context. Cross-cultural adaptation is an essential step in ensuring the equivalence in the meaning of the instrument at a conceptual level across cultures [49]. The study evaluated a mixed population of critically ill patients, supporting the generalizability and the external validity of our findings. In addition, delirium assessments were carried out within two hours to

reduce the risk of variability in terms of diagnosis due to the fluctuating nature of delirium. Furthermore, subgroup analysis was conducted to measure the psychometric features of ICDSC according to examiners assessment at each site.

The main limitations of our study are that evaluations occurred once during ICU stay; in this case the overall delirium prevalence might have been underestimated. A relatively small number of patients with neurological diagnosis were enrolled limiting the generalizability to this specific patient group. While there may have been differences in the patients' characteristics between the institutions, we cannot provide a full comparison of some data that were not captured such as the APACHE scores.

Moreover, while ventilated patients were not excluded, few ventilated patients were enrolled, limiting the generalizability of our findings.

5. Conclusions

The Arabic ICDSC is a valid and reliable tool for the detection of delirium among Arabic speaking critically ill patients and should therefore be incorporated in the daily ICU practice in Arabic ICU settings. Future studies could address whether these findings are generalizable to a higher proportion of mechanically ventilated patients while documenting their validity across a broad range of illness severity markers (e.g. APACHE scores), and address acceptability and reliability in other Arabic language critical care settings.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

Declaration of Competing Interest

None.

Acknowledgement

The authors would like to thank all the ICU clinicians and staff at study sites for making this study possible. We are grateful to Ms. Khawla Ammar and Ms. Dalia Alrimawi for their help in data analysis and statistics.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jcrc.2019.08.025>.

References

- [1] American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed. Washington, DC: American Psychiatric Association; 2013.
- [2] Ouimet S, Kavanagh BP, Gottfried SB, Skrobik Y. Incidence, risk factors and consequences of ICU delirium. *Intensive Care Med* 2007;33(1):66–73.
- [3] Wang H, Salluh JI, Schneider EB, Nagaraja N, Yenokyan G, Damluji A, et al. Outcome of delirium in critically ill patients: systematic review and meta-analysis. *BMJ* 2015; 350:h2538.
- [4] van den Boogaard M, Schoonhoven L, van der Hoeven JG, van Achterberg T, Pickkers P. Incidence and short-term consequences of delirium in critically ill patients: a prospective observational cohort study. *Int J Nurs Stud* 2012;49(7):775–83.
- [5] Ely EW, Gautam S, Margolin R, Francis J, May L, Speroff T, et al. The impact of delirium in the intensive care unit on hospital length of stay. *Intensive Care Med* 2001;27(12):1892–900.
- [6] Milbrandt EB, Deppen S, Harrison PL, Shintani AK, Speroff T, Stiles RA, et al. Costs associated with delirium in mechanically ventilated patients. *Crit Care Med* 2004;32(4):955–62.
- [7] Witlox J, Eurelings LS, de Jonghe JF, Kalisvaart KJ, Eikelenboom P, van Gool WA. Delirium in elderly patients and the risk of postdischarge mortality, institutionalization, and dementia: a meta-analysis. *JAMA* 2010;304(4):443–51.

- [8] Ely EW, Shintani A, Truman B, Speroff T, Gordon SM, Harrell Jr FE, et al. Delirium as a predictor of mortality in mechanically ventilated patients in the intensive care unit. *JAMA* 2004;291(14):1753–62.
- [9] Girard TD, Jackson JC, Pandharipande PP, Pun BT, Thompson JL, Shintani AK, et al. Delirium as a predictor of long-term cognitive impairment in survivors of critical illness. *Crit Care Med* 2010;38(7):1513–20.
- [10] Bickel H, Gradinger R, Kochs E, Förstl H. High risk of cognitive and functional decline after postoperative delirium: a three-year prospective study. *Dement Geriatr Cogn Disord* 2008;26(1):26–31.
- [11] Devlin JW, Skrobik Y, Gélinas C, Needham DM, Slooter AJC, Pandharipande PP, et al. Clinical practice guidelines for the prevention and management of pain, agitation/sedation, delirium, immobility, and sleep disruption in adult patients in the ICU. *Crit Care Med* 2018;46(9):e825–73.
- [12] Ely EW, Margolin R, Francis J, May L, Truman B, Dittus R, et al. Evaluation of delirium in critically ill patients: validation of the confusion assessment method for the intensive care unit (CAM-ICU). *Crit Care Med* 2001;29(7):1370–9.
- [13] Bergeron N, Dubois MJ, Dumont M, Dial S, Skrobik Y. Intensive care delirium screening checklist: evaluation of a new screening tool. *Intensive Care Med* 2001;27(5):859–64.
- [14] van Zyl LT, Davidson PR. Delirium in hospital: an underreported event at discharge. *Can J Psychiatr* 2003;48(8):555–60.
- [15] Ely EW, Stephens RK, Jackson JC, Thomason JW, Truman B, Gordon S, et al. Current opinions regarding the importance, diagnosis, and management of delirium in the intensive care unit: a survey of 912 healthcare professionals. *Crit Care Med* 2004;32(1):106–12.
- [16] Spronk PE, Riekerk B, Hofhuis J, Rommes JH. Occurrence of delirium is severely underestimated in the ICU during daily care. *Intensive Care Med* 2009;35(7):1276–80.
- [17] Mac Sweeney R, Barber V, Page V, Ely EW, Perkins GD, Young JD, et al. A national survey of the management of delirium in UK intensive care units. *QJM* 2010;103(4):243–51.
- [18] Mehta S, Burry L, Fischer S, Martinez-Motta JC, Hallett D, Bowman D, et al. Canadian survey of the use of sedatives, analgesics, and neuromuscular blocking agents in critically ill patients. *Crit Care Med* 2006;34(2):374–80.
- [19] Morandi A, Piva S, Ely EW, Myatra SN, Salluh JIF, Amare D, et al. Worldwide survey of the “assessing pain, both spontaneous awakening and breathing trials, choice of drugs, delirium monitoring/management, early exercise/mobility, and family empowerment” (ABCDEF) bundle. *Crit Care Med* 2017;45:e1111–22.
- [20] Devlin JW, Fong JJ, Fraser GL, Riker RR. Delirium assessment in the critically ill. *Intensive Care Med* 2007;33(6):929–40.
- [21] Lamond E, Murray S, Gibson CE. Delirium screening in intensive care: a life saving opportunity. *Intensive Crit Care Nurs* 2018;44(2):105–9.
- [22] Aljuaid MH, Deeb AM, Dbsawy M, Alsayegh D, Alotaibi M, Arabi YM. Psychometric properties of the Arabic version of the confusion assessment method for the intensive care unit (CAM-ICU). *BMC Psychiatry* 2018;18(1):91.
- [23] Selim A, Kandeel N, Elokli M, Khater MS, Saleh AN, Bustami R, et al. The validity and reliability of the Arabic version of the confusion assessment method for the intensive care unit (CAM-ICU): a prospective cohort study. *Int J Nurs Stud* 2018;80(4):83–9.
- [24] Guenther U, Popp J, Koecher L, Muders T, Wrigge H, Ely EW, et al. Validity and reliability of the CAM-ICU flowsheet to diagnose delirium in surgical ICU patients. *J Crit Care* 2010;25(1):144–51.
- [25] Larsson C, Axell AG, Ersson A. Confusion assessment method for the intensive care unit (CAM-ICU): translation, retranslation and validation into Swedish intensive care settings. *Acta Anaesthesiol Scand* 2007;51(7):888–92.
- [26] Gaspardo P, Peressoni L, Comisso I, Mistraletti G, Ely EW, Morandi A. Delirium among critically ill adults: evaluation of the psychometric properties of the Italian confusion assessment method for the intensive care unit. *Intensive Crit Care Nurs* 2014;30(5):283–91.
- [27] Adamis D, Dimitriou C, Anifantaki S, Zachariadis A, Astrinaki I, Alegakis A, et al. Validation of the Greek version of confusion assessment method for the intensive care unit (CAM-ICU). *Intensive Crit Care Nurs* 2012;28(6):337–43.
- [28] Vreeswijk R, Honing M, Bakker K, Spronk P, De Man T, De Jonghe J, et al. Translation, retranslation and validation of the Dutch confusion assessment method for the intensive care unit. *Crit Care* 2008;12(Suppl. 2):P515.
- [29] Mitasova A, Kostalova M, Bednarik J, Michalcakova R, Kasperek T, Balabanova P, et al. Poststroke delirium incidence and outcomes: validation of the confusion assessment method for the intensive care unit (CAM-ICU). *Crit Care Med* 2012;40(2):484–90.
- [30] Wang C, Wu Y, Yue P, Ely EW, Huang J, Yang X, et al. Delirium assessment using confusion assessment method for the intensive care unit in Chinese critically ill patients. *J Crit Care* 2013;28(3):223–9.
- [31] Pipanmekaporn T, Wongpakaran N, Mueankwan S, Dendumrongkul P, Chittawatanarat K, Khongpheng N, et al. Validity and reliability of the Thai version of the confusion assessment method for the intensive care unit (CAM-ICU). *Clin Interv Aging* 2014;9:879–85.
- [32] Heo EY, Lee BJ, Hahm BJ, Song EH, Lee HA, Yoo CG, et al. Translation and validation of the Korean confusion assessment method for the intensive care unit. *BMC Psychiatry* 2011;11:94.
- [33] Koga Y, Tsuruta R, Murata H, Matsuo K, Ito T, Ely EW, et al. Reliability and validity assessment of the Japanese version of the confusion assessment method for the intensive care unit (CAM-ICU). *Intensive Crit Care Nurs* 2015;31(3):165–70.
- [34] Kose G, Bolu A, Ozdemir L, Acikel C, Hatipolu S. Reliability and validity of the intensive care delirium screening checklist in Turkish. *Int J Nurs Knowl* 2016;27(2):119–24.
- [35] Gusmao-Flores D, Salluh JI, Dal-Pizzol F, Ritter C, Tomasi CD, Lima MA, et al. The validity and reliability of the Portuguese versions of three tools used to diagnose delirium in critically ill patients. *Clinics (Sao Paulo)* 2011;66(11):1917–22.
- [36] Koga Y, Murata H, Yamase H. Validity and reliability of the Japanese version of intensive care delirium screening checklist (ICDSC). *Yamaguchi Med J* 2014;63:103–11.
- [37] George C, Nair JS, Ebenezar JA, Gangadharan A, Christudas A, Gnanaseelan LK, et al. Validation of the intensive care delirium screening checklist in nonintubated intensive care unit patients in a resource-poor medical intensive care setting in South India. *J Crit Care* 2011;26(2):138–43.
- [38] van Eijk MM, van Marum RJ, Klijn IA, de Wit N, Kesecioglu J, Slooter AJ, et al. Comparison of delirium assessment tools in a mixed intensive care unit. *Crit Care Med* 2009;37(6):1881–5.
- [39] Neziraj M, Sarac Kart N, Samuelson K. The intensive care delirium screening checklist: translation and reliability testing in a Swedish ICU. *Acta Anaesthesiol Scand* 2011;55(7):819–26.
- [40] Larsen LK, Frøkjær VG, Nielsen JS, Skrobik Y, Winkler Y, Møller K, et al. Delirium assessment in neuro-critically ill patients: a validation study. *Acta Anaesthesiol Scand* 2019;63(3):352–9.
- [41] Wild D, Grove A, Martin M, Eremenco S, McElroy S, Verjee-Lorenz A, et al. Principles of good practice for the translation and cultural adaptation process for patient-reported outcomes (PRO) measures: report of the ISPOR task force for translation and cultural adaptation. *Value Health* 2005;8(2):94–104.
- [42] American Psychiatric Association. Task force on DSM-IV. Diagnostic and statistical manual of mental disorders: DSM-IV-TR. 4th ed. Washington, DC: American Psychiatric Association; 2000.
- [43] Inouye SK, Westendorp RG, Saczynski JS. Delirium in elderly people. *Lancet* 2014;383(9920):911–22.
- [44] Salluh JI, Sharshar T, Kress JP. Does this patient have delirium? *Intensive Care Med* 2017;43(5):693–5.
- [45] Bilge EÜ, Kaya M, Şenel GÖ, Ünver S. The incidence of delirium at the postoperative intensive care unit in adult patients. *Turk J Anaesthesiol Reanim* 2015;43(4):232–9.
- [46] Mori S, Takeda JR, Carrara FS, Cohrs CR, Zanei SS, Whitaker IY. Incidence and factors related to delirium in an intensive care unit. *Rev Esc Enferm USP* 2016;50(4):587–93.
- [47] Gesin G, Russell BB, Lin AP, Norton HJ, Evans SL, Devlin JW. Impact of a delirium screening tool and multifaceted education on nurses' knowledge of delirium and ability to evaluate it correctly. *Am J Crit Care* 2012;21(1):e1–11.
- [48] Marquis F, Ouimet S, Riker R, Cossette M, Skrobik Y. Individual delirium symptoms: do they matter? *Crit Care Med* 2007;35(11):2533–7.
- [49] Hambleton RK, Patsula L. Adapting tests for use in multiple languages and cultures. *Soc Indic Res* 1998;45:153–71.