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ORIGINAL PAPER

COMPARING THE CAM-ICU AND ICDSC FOR ASSESSING DELIRIUM IN NON-INTUBATED INTENSIVE CARE PATIENTS

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Abstract

Aim: The study compared two instruments for detecting delirium, the Intensive Care Delirium Screening Checklist (ICDSC) and the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU) as a reference method. *Design:* Prospective observational study. *Methods:* The study included 126 consecutive patients staying in the intensive care unit (ICU) for more than 24 hours. The diagnostic properties of both questionnaires and agreement between them were studied and compared. Additionally, the two tests were used to assess the relationship between selected patient parameters and the presence of delirium. *Results:* There was a high level of agreement between the CAM-ICU and ICDSC, as expressed by Cohen's κ of 0.829 (95% CI: 0.821–0.838). Cronbach's α assessing the internal consistency of a Czech version of the CAM-ICU and ICDSC was 0.903 and 0.865, respectively. The CAM-ICU had 85.5% sensitivity (95% CI: 84.6–91.8) and 94.1% specificity (95% CI: 92.4–95.5); the ICDSC (cut-off ≥ 4) had 90.6% sensitivity (95% CI: 87.0–93.5) and 89.0% specificity (95% CI: 86.8–91.0). *Conclusion:* Both compared diagnostic instruments, the CAM-ICU and ICDSC, appear to be adequate and usable. When compared with the CAM-ICU as a reference method, the ICDSC showed similar results and a good level of agreement.

Keywords: Confusion Assessment Method for the Intensive Care Unit (CAM-ICU), delirium, Intensive Care Delirium Screening Checklist (ICDSC), intensive care unit (ICU).

Introduction

Delirium is common in intensive care, posing a serious problem. In intensive care unit (ICU) patients, delirium worsens outcomes, increases mortality, and prolongs hospital stays (Ely et al., 2001a, 2001c, 2004).

Other negative impacts are, for example, persisting cognitive impairment after hospital discharge (Van Rompaey et al., 2009) and increased healthcare costs (Milbrandt et al., 2004; Vasilevskis et al., 2018). Despite its significance, delirium is often underdiagnosed, in particular the so-called hypoactive form (Kean & Ryan, 2008; van Eijk et al., 2011).

Today, delirium prevention and management – alongside pain management, adequate sedation and emphasis on early awakening, and weaning from mechanical ventilation and mobilization – are integral parts of a standardized, widely accepted, and well-established protocol for daily routine care in the ICU – the so-called ABCDE bundle (Morandi et al., 2011). Emphasis is placed on non-pharmacological intervention (removal of precipitating factors) as well as on routine screening, early diagnosis, and monitoring the course of delirium using clinical diagnostic tools that are of key importance to early detection (Gélinas et al., 2018). The current international recommendations, or PADIS guidelines (*Clinical practice guidelines for the prevention and management of pain, agitation / sedation, delirium, immobility, and sleep disruption in adult patients in the ICU*, Devlin et al., 2018), strongly encourage repeated daily routine assessment of the presence of delirium with reliable, validated instruments. The most studied and most widely used in adults globally are the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU) and Intensive Care Delirium Screening Checklist (ICDSC).

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The CAM-ICU, developed and standardized by E. Wesley Ely, is adapted as the most frequently used instrument for detecting delirium in clinical practice (Inouye et al., 1990). Delirium is diagnosed in two steps: first, the level of arousal is assessed using a sedation and agitation scale (Richmond Agitation-Sedation Scale, RASS); then, the presence / absence of delirium is assessed using four features, with delirium being ruled out if all of them are absent. A positive result or an inconsistent (fluctuating) level of arousal means that delirium cannot be ruled out and the test needs to be repeated at regular intervals (Ely et al., 2001b). The Czech version of the CAM-ICU was validated in 2010 (Mitášová et al., 2010).

By contrast, the ICDSC contains eight items adapted from the internationally recognized *Diagnostic and statistical manual of mental disorders* (Bergeron et al., 2001). The threshold for a positive result (presence of delirium) is 4 points (99% sensitivity; 64% specificity). A potential advantage of the ICDSC is that the instrument is able to diagnose hypoactive (oligosymptomatic, subsyndromal) forms of delirium (1–3 points) also deserving attention, as their impact is equally negative and they are often underdiagnosed.

The risk factors for developing delirium may be divided into predisposing (non-modifiable, suitable for prediction) and precipitating (potentially modifiable). The predisposing factors include, among others, age, gender, and a history of substance abuse (tobacco, alcohol); the precipitating factors are type of admission (surgical vs. medical), severity of the condition (nursing workload measured with the *Therapeutic Intervention Scoring System*, TISS), ICU length of stay, overall length of hospital stay, sedative medications (analgosedation, psychotherapeutic drugs) and physical restraints (straps).

Aim

The aim was to identify an optimal instrument for detecting delirium in the intensive care setting in the Czech Republic by comparing the Czech version of the ICDSC and CAM-ICU (the gold standard) and their psychometric properties. The secondary objective was to look for associations between the presence of delirium and selected variables.

Methods

Design

A prospective observational study.

Sample

The sample comprised 126 consecutive patients staying in the Department of Anesthesiology and Intensive Care Medicine (5 beds) and multidisciplinary ICU (10 beds) of AGEL Hospital in Valašské Meziříčí for more than 24 hours between February and August 2020. Excluded from the study were terminal patients, those under deep sedation (RASS score below -4), with impaired consciousness (Glasgow Coma Scale [GCS] score below 12), or with dementia, and individuals refusing to participate in the study.

Data collection

In all 126 patients, nurses used both instruments for screening delirium twice daily throughout their hospital stay. Thus, a total of 1,299 paired questionnaires were obtained. On average, the form took approximately 5 minutes to complete. The data were collected between February and August 2020.

Process of translation

In the Czech Republic, the CAM-ICU was validated by a team of experts from Brno (Mitášová et al., 2010) who consented to the use of their Czech version in the present study. The original ICDSC was requested directly from its author. In accordance with the guidelines and standards for the translation and cultural adaptation of patient-reported outcome measures, the instrument was translated and linguistically validated (Wild et al., 2005).

The translation of the instrument included the following steps: 1) forward translation – the English version translated into the Czech language by two independent professional translators and merged into a single Czech version; 2) back translation – the Czech version translated back into English, followed by identification and resolution of discrepancies between the original source and the back translation; 3) expert review – the final Czech version agreed on by a panel of experts; and 4) pilot testing – the instrument tested on 10 patients staying in a multidisciplinary ICU of AGEL Hospital in Valašské Meziříčí (not included in the final sample).

The linguistic validation process took 5 weeks.

Diagnostic instruments: CAM-ICU vs ICDS

When using the CAM-ICU to diagnose delirium, the first step is to assess arousal with the RASS scale, with scores ranging from +4 (overtly combative, immediate danger to staff) to -5 (no response to any stimulation). In deeply sedated patients (RASS score -4 and -5), the presence of delirium cannot be established and the test needs to be repeated later.

In responsive and awake patients (RASS score -3 to +4), the second step follows. This involves assessing four main features of delirium: acute change or fluctuating course of mental status (Feature 1); inattention (Feature 2); altered level of consciousness (Feature 3); and disorganized thinking (Feature 4). Delirium is deemed positive when Feature 1 and Feature 2 and either Feature 3 or 4 are present; otherwise, the patient is CAM-ICU negative. RASS scores ranging from 0 to -3 are associated with hypoactive delirium. A RASS score of +1 or more suggests hyperactive delirium. Mixed delirium is when the patient fluctuates between the two forms (Mitášová et al., 2010).

The ICDSC includes the following 8 items: altered level of consciousness, inattention, disorientation, hallucination-delusion-psychosis, psychomotor agitation or retardation, inappropriate speech or mood, sleep / wake cycle disturbance, and symptom fluctuation. Each positive item scores one point. If the total score is 0, delirium is ruled out. Scores of 1–3 indicate subsyndromal delirium; with a score of ≥ 4, delirium is fully manifest (Bergeron et al., 2001).

Data analysis

Relationships between pairs of metric, ordinal, or binary variables were tested using a robust Kendall's τ coefficient. The relationships between metric and dichotomous variables were also tested using receiver operating characteristics (ROC) enabling us to find the optimum cut-off values for individual metric predictors and to estimate the quality of discrimination (sensitivity, specificity at the optimum cut-off value). The optimum cut-off values of metric variables were detected at maximum Youden's J statistic (sensitivity + specificity -1). The relationships between dichotomous variables were also evaluated using Fisher's exact test.

The estimation of the internal consistency was completed using Cronbach's α statistic following Spearman's correlations. The interobserver reliability was tested using Cohen's κ.

Respecting the skewed data distribution and non-constant variance in metric data, these were transformed by power transformations to achieve data symmetry and homoscedasticity prior to further processing by parametric methods. The homogeneity and distribution of the transformed data were checked by residual analysis as described elsewhere. The statistical software Statgraphics Centurion Version XV from Statpoint Technologies, Inc. (Herndon, Virginia, USA) was used for the power transformations.

Results

Over the study period, a total of 397 ICU patients were initially considered eligible for participation. Subsequently, however, 271 (68%) of them were eliminated for meeting the exclusion criteria (152 stayed in the ICU < 24 hours, 6 disagreement with research, 27 diagnosed dementia, 18 pre finem state, 68 presented GCS < 12, RASS -4 or -5). Out of 1,299 paired questionnaires (collected from 126 patients), 326 (25.1%) were positive (delirium present) and 973 (74.9%) were negative.

Cohen's κ was 0.829 (95% CI: 0.821–0.838), indicating a nearly perfect agreement between the CAM-ICU and ICDSC (Table 1). Cronbach's α measuring the internal consistency of the CAM-ICU Czech version was 0.903. The ICDSC was assessed in the same way, with a Cronbach's α of 0.865. The minimum acceptable value is normally 0.7, with 0.8–0.9 being considered very good values (Terwee et al., 2007).

The diagnostic power of the tests was analysed using Youden's J statistic, with the CAM-ICU being considered the gold standard. The sensitivity and specificity for the CAM-ICU were 88.5% (95% CI: 84.6–91.8) and 94.1% (95% CI: 92.4–95.5), respectively. The area under the ROC curve (AUC) parameter for the CAM-ICU was 0.956 (95% CI: 0.939–0.967) and Youden's index was 0.826. The sensitivity and specificity for the ICDSC (cut-off ≥ 4) was 90.6% (95% CI: 87.0–93.5) and 89.0% (95% CI: 86.8–91.0), respectively. The AUC for the ICDSC was 0.956 (95% CI: 0.941–0.967) and Youden's index was 0.796. The discriminative ability of a test may be good (AUC 0.75–0.92), very good (AUC 0.92–0.97) or excellent (AUC 0.97–1.00).

The study also analysed the strength of relationships between the presence of delirium (assessed by both instruments) and selected parameters using Kendall's τ coefficient. Relationships were identified ($p < 0.001$) between delirium (assessed with the CAM-ICU) and the following parameters: alcohol consumption, depth of sedation / impaired consciousness (RASS / GCS), pain (visual analog scale, VAS) and nursing workload (TISS). For ICU length of stay and overall length of hospital stay, no significant relationship was found ($p > 0.001$). In case of a confirmed relationship, the strength of the relationship was analysed using Kendall's τ (95% CI) (Hendl, 2012). Increasing values (from -1 to +1) indicate increasing strength of the relationship.

A positive or negative sign indicates a direct or inverse relationship, respectively. The identified relationships for individual parameters, ordered by strength and regardless of dependency, were as

Table 1 Incidence of delirium according to ICDSC / CAM-ICU

			ICDSC > 4		
			-	+	Total
CAM-ICU	-	n	921	52	973
		% of Total	70.9	4.0	74.9
		% within Row	94.7	5.3	100.0
		% within Column	96.3	15.2	74.9
	+	n	35	291	326
		% of Total	2.7	22.4	25.1
		% within Row	10.7	89.3	100.0
		% within Column	3.7	84.8	25.1
	Total	n	956	343	1,299
		% of Total	73.6	26.4	100.0
		% within Row	73.6	26.4	100.0
		% within Column	100.0	100.0	100.0
Statistical tests			**χ2 value**	**DF**	**p-value**
	χ^2 test		885	1	p < 0.001
	Fisher's exact test				p < 0.001

Cohen's κ (CI 95%) = 0.829 (0.821; 0.838); CAM-ICU – Confusion Assessment Method for the Intensive Care Unit; ICDSC – Intensive Care Delirium Screening Checklist; DF – degrees of freedom

follows: GCS (-0.731), VAS (+0.347), RASS (+0.190), alcohol (+0.105), TISS (+0.180) (see Table 2 for details).

As for binary variables (present / absent), relationships were confirmed for the following (strength): straps (+0.509), administration of benzodiazepines (+0.225), administration of antipsychotics (+0.195), smoking (+0.191), death in the ICU (+0.189), death in the hospital (+0.162), administration of opioids (+0.152), mechanical ventilation (+0.122) and surgery (-0.114). For three variables (nursing shift type, gender, type of admission), no significant relationship was confirmed (Table 3).

Similarly, the ICDSC was analysed, with a score of ≥ 4, indicating fully manifest delirium. The same analysis showed statistically significant (p < 0.001) relationships having the respective strength for the following parameters (once again ordered by absolute values of the relationships): GCS (-0.731), VAS (+0.328), RASS (+0.184), TISS (-0.129), alcohol (+0.0997), and ICU length of stay (+0.0617). For age and length of hospital stay, no significant relationship was found (p > 0.001) (see Table 4 for details).

As for binary variables, relationships were confirmed for straps (+0.496), antipsychotics (+0.231), benzodiazepines (+0.211), opioids (+0.173), death in the ICU (+0.219), death in the hospital (+0.164), mechanical ventilation (+0.199), smoking (+0.224), and male gender (+0.102). For the following variables, significant relationships (p > 0.001) were not found: shift, surgery, and admission types (see Table 5 for details).

Table 2 Relationships between CAM-ICU and metric indices (n = 1,299)

Variable	ICU-		ICU+		Kendall's τ (95% CI)	p-value
	n	median (quartiles)	n	median (quartiles)		
Alcohol	973	1 (1; 1)	326	1 (1; 2)	0.105 (0.0693; 0.141)	< 0.001
Age	973	71 (60; 78)	326	70 (60; 82)	0.0198 (-0.0162; 0.0557)	0.390
Length of ICU stay	973	8 (5; 13)	326	9 (6; 13)	0.0283 (-0.0077; 0.0642)	0.228
Length of hospital stay	973	19 (10; 29)	326	17 (14; 24)	-0.0145 (-0.0505; 0.0215)	0.529
GCS	973	15 (15; 15)	326	14 (13; 14)	-0.731 (-0.747; -0.713)	< 0.001
VAS	973	1 (0; 2)	326	3 (1; 4)	0.347 (0.315; 0.378)	< 0.001
TISS	973	557 (555; 558)	326	557 (555; 557)	-0.18 (-0.12; -0.0485)	< 0.001
RASS	973	0 (0; 0)	326	1 (-1; 2)	0.19 (0.156; 0.225)	< 0.001

CI – Confidence Interval; GCS – Glasgow Coma Scale; ICU – Intensive Care Unit; RASS – Richmond Agitation Sedation Scale; TISS – Therapeutic Intervention Scoring System; VAS – Visual Analog Scale

Table 3 Relationships between CAM-ICU and binary indices (n = 1,299)

Variable	ICU-		ICU+		Kendall's τ (95% CI)	p-value
	n	%	n	%		
Shift	540	55.5	182	55.8	0.0029 (-0.0331; 0.0389)	0.918
Mechanical ventilation	265	27.2	131	40.2	0.122 (0.0863; 0.157)	< 0.001
Smoking	291	29.9	166	50.9	0.191 (0.156; 0.225)	< 0.001
Men	588	60.4	217	66.6	0.0548 (0.0188; 0.0906)	0.049
Benzodiazepines	65	6.7	74	22.7	0.225 (0.19; 0.259)	< 0.001
Opiates	205	21.1	118	36.2	0.152 (0.116; 0.187)	< 0.001
Antipsychotics	229	23.5	143	43.9	0.195 (0.16; 0.229)	< 0.001
Operation	327	33.6	70	21.5	-0.114 (-0.15; -0.0785)	< 0.001
Type of admission	813	83.6	270	82.8	-0.0085 (-0.0445; 0.0275)	0.758
Restraints	16	1.6	124	38.0	0.509 (0.482; 0.535)	< 0.001
ICU mortality	77	7.9	71	21.8	0.189 (0.154; 0.224)	< 0.001
Hospital mortality	134	13.8	91	27.9	0.162 (0.127; 0.197)	< 0.001

CI – Confidence Interval; ICU – Intensive Care Unit

Table 4 Validities of the Czech versions of the CAM-ICU and ICDSC

Tool	Senzitivity % (95% CI)	Specificity % (95% CI)	Accuracy % (95% CI)	AUC (95% CI)	Youden's statistic
CAM-ICU	88.5 (84.6–91.8)	94.1 (92.4–95.5)	92.7 (86.7–94.4)	0.9555 (0.939– 0.967)	0.826
ICDSC*	90.6 (87–93.5)	89 (86.8–91)	89.4 (85.1–90.6)	0.956 (0.941 – 0.967)	0.796

*AUC – Area under curve; CAM-ICU – Confusion Assessment Method for the Intensive Care Unit; CI – Confidence Interval; ICDSC – Intensive Care Delirium Screening Checklist; *Using cutoff score ≥ 4*

Table 5 Relationships between ICDSC scale and binary indices (cut-off value 4) (n = 1,299)

Variable	Symptoms < 4		Symptoms ≥ 4		Kendall's τ (95% CI)	p-value
	n	%	n	%		
Shift	527	55.1	195	56.9	0.0153 (-0.0207; 0.0513)	0.581
Mechanical ventilation	239	25.0	157	45.8	0.199 (0.164; 0.233)	< 0.001
Smoking	275	28.8	182	53.1	0.224 (0.19; 0.258)	< 0.001
Men	564	59.0	241	70.3	0.102 (0.0666; 0.138)	< 0.001
Benzodiazepines	65	6.8	74	21.6	0.211 (0.176; 0.245)	< 0.001
Opiates	195	20.4	128	37.3	0.173 (0.137; 0.207)	< 0.001
Antipsychotics	214	22.4	158	46.1	0.231 (0.197; 0.265)	< 0.001
Operation	310	32.4	87	25.4	-0.0676 (-0.103; -0.0317)	0.015
Type of admission	785	82.1	298	86.9	0.0564 (0.0205; 0.0922)	0.042
Restraints	15	1.6	125	36.4	0.496 (0.468; 0.522)	< 0.001
ICU mortality	69	7.2	79	23.0	0.219 (0.185; 0.253)	< 0.001
Hospital mortality	130	13.6	95	27.7	0.164 (0.129; 0.199)	< 0.001

ICU – Intensive Care Unit

Discussion

Validity of the assessment instruments (both the CAM-ICU and ICDSC) was repeatedly tested in various types of ICUs throughout the world. A Brazilian review (Gusmao-Flores et al., 2012) aimed to evaluate the evidence on the accuracy of the CAM-ICU and ICDSC for the diagnosis of delirium in critically ill patients. It showed that the CAM-ICU was an excellent diagnostic instrument in these patients (pooled sensitivity 80.0%, pooled specificity 95.9%), whereas the ICDSC had moderate sensitivity (pooled sensitivity 74.0%) and good specificity (pooled specificity 81.9%). Also the pooled AUC of the CAM-ICU was higher (0.97 vs. 0.87). Many authors directly comparing the diagnostic accuracy of the CAM-ICU and ICDSC reported inconsistent results. Indian authors (Barman et al., 2018) found that the CAM-ICU was more sensitive than the ICDSC (84.4% vs. 77.8 %) but the specificity was identical (94.6%). The CAM-ICU had better sensitivity and specificity than the ICDSC (64% vs. 43% and 95% vs. 88%, respectively) in the Dutch study (van Eijk et al., 2009). Contrary to those results, the present study found higher sensitivity of the ICDSC (90.6% vs. 88.5%); on the other hand, higher specificity of the CAM-ICU (94.1% vs. 89%) is consistent with the above papers. The detected, nearly identical, AUC values (≥ 0.9) suggest that both instruments are very good for diagnosing delirium (Terwee et al., 2007).

The agreement between assessments with the CAM-ICU and ICDSC was analysed by several studies (Fagundes et al., 2012; Plaschke et al., 2008; Tomasi et al., 2012) reporting Cohen's κ between 0.53 and 0.92. According to Fagundes et al. (2012), this variability seems to be affected mainly by disease severity. The present study showed a nearly perfect agreement (0.829). The reliability rates assessed in 1,299 questionnaires using Cronbach's α were 0.903 for the CAM-ICU and 0.865 for the ICDSC. The results suggest that both instruments are accurate, reliable, and usable in the ICU setting in the Czech Republic. Similar internal consistency results were also reported by other authors. In a Turkish study (Kose et al., 2016), Cronbach's α ranged from 0.720 to 0.850. An acceptable value (0.63) was reported for an Arabic version (Al-Qadheeb et al., 2019). A Belgian study showed a value of 0.839.

In two different studies (Adamis et al., 2012; Tobar et al., 2010), the CAM-ICU had identical internal consistency (Cronbach's α 0.84). A lower value (0.69) was shown in a study using a Japanese translation (Koga et al., 2015). A significant clinical advantage of the CAM-ICU is that it has been validated for use in mechanically ventilated patients (Mitášová et al., 2010). The ICDSC cannot be used in these patients.

When assessing relationships with predisposing and precipitating factors for developing delirium, a significant agreement between the two instruments may be detected. For both, the strongest relationship, as assessed with Kendall's τ, is found with impaired consciousness, or lower GCS scores. The present study confirmed that with decreasing GCS scores the positivity of both tests increases. This is consistent with findings by Maneewong et al. (2017) who also showed the association between lower GCS scores (particularly the verbal response component) and higher positivity when assessing delirium. The present study also identified a strong relationship between the presence of delirium and pain, as assessed with the VAS. This association is consistent with the so-called multifactorial model of delirium, involving vulnerability and accumulation of multiple risk factors (Woo & Ratnayake, 2020). From this perspective, analgesia and sedation (and monitoring of their adequacy and depth) is a key measure in preventing, or managing, delirium in the ICU. Physical restraints (straps) are also associated with higher delirium rates. The international EUNOMIA study (Kallert et al., 2005) assessing the clinical practice of coercive treatment measures in 12 European countries showed varied approaches to their use and a dearth of studies comparing the differences regarding the incidence of delirium.

The incidence of delirium due to alcohol withdrawal syndrome in surgical ICUs is reported to range from 8% to 40%. In the present study, a significant relationship between alcohol consumption and delirium was also shown by both instruments. The severity of the condition, as assessed by nursing workload (TISS), is associated with higher delirium rates, indirectly illustrating increased healthcare costs of delirium-positive patients. This fact was noted by some earlier studies (Milbrandt et al., 2004; Vasilevskis et al., 2018). The present study also showed an association of delirium with mechanical ventilation and death, consistently with previous studies reporting delirium as a predictor of prolonged mechanical ventilation, ICU and hospital stays, as well of higher mortality (Ely et al., 2001c, 2004).

Conclusion

Both instruments for detecting delirium (CAM-ICU, ICDSC) are accurate and reliable enough to be used in the intensive care setting. However, the ICDSC cannot be used in mechanically ventilated patients. Their routine use in daily practice may reduce the negative impact on intensive care outcomes brought about by this frequent, and often underdiagnosed, complication of ICU stays. The confirmed association between delirium detection and selected predisposing / precipitating factors may be used to prevent delirium.

Ethical aspects and conflict of interest

The authors declare that there is no conflict of interest regarding the study and that ethical aspects were considered while processing the results. All literature sources were properly cited.

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Author contributions

Concept and design (HL), data collection (HL), analysis and interpretation of the data (HL), processing and design of the manuscript (HL), critical revision of the manuscript (KA).

References

Adamis, D., Dimitriou, C., Anifantaki, S., Zachariadis, A., Astrinaki, I., Alegakis, A., Mari, H., & Tsiatsiotis, N. (2012). Validation of the Greek version of Confusion Assessment Method for the Intensive Care Unit (CAM-ICU). *Intensive & Critical Care Nursing*, *28*(6), 337–343. https://doi.org/10.1016/j.iccn.2012.02.003

Al-Qadheeb, N. S., Nazer, L. H., Aisa, T. M., Osman, H. O., Rugaan, A. S., Alzahrani, A. S., Ghonimat, I. M., Mohammed, A. M., Maghrabi, K., Alrowaished, A. A., Hussein, N. H., Maslamani, Y. A., Falatah, S., & Skrobik, Y. (2019). Arabic intensive care delirium screening checklist's validity and reliability: a multicenter study. *Journal of Critical Care*, *54*, 170–174. https://doi.org/10.1016/j.jcrc.2019.08.025

Barman, A., Pradhan, D., Bhattacharyya, P., Dey, S., Bhattacharjee, A., Tesia, S. S., & Mitra, J. K. (2018). Diagnostic accuracy of delirium assessment methods in critical care patients. *Journal of Critical Care*, *44*, 82–86. https://doi.org/10.1016/j.jcrc.2017.10.013

Bergeron, N., Dubois, M. J., Dumont, M., Dial, S., & Skrobik, Y. (2001). Intensive care delirium screening checklist: evaluation of a new screening tool. *Intensive Care Medicine*, *27*(5), 859–864. https://doi.org/10.1007/s001340100909

Devlin, J. W., Skrobik, Y., Gélinas, C., Needham, D. M., Slooter, A., Pandharipande, P. P., Watson, P. L., Weinhouse, G. L., Nunnally, M. E., Rochwerg, B., Balas, M. C., van den Boogaard, M., Bosma, K. J., Brummel, N. E., Chanques, G., Denehy, L., Drouot, X., Fraser, G. L., Harris, J. E., Joffe, A. M., … & Alhazzani, W. (2018). Clinical practice guidelines for the prevention and management of pain, agitation / sedation, delirium, immobility, and sleep disruption in adult patients in the ICU. *Critical Care Medicine*, *46*(9), e825–e873. https://doi.org/10.1097/CCM.0000000000003299

Ely, E. W., Inouye, S. K., Bernard, G. R., Gordon, S., Francis, J., May, L., Truman, B., Speroff, T., Gautam, S., Margolin, R., Hart, R. P., & Dittus, R. (2001a). Delirium in mechanically ventilated patients: validity and reliability of the confusion assessment method for the intensive care unit (CAM-ICU). *JAMA*, *286*(21), 2703–2710. https://doi.org/10.1001/jama.286.21.2703

Ely, E. W., Margolin, R., Francis, J., May, L., Truman, B., Dittus, R., Speroff, T., Gautam, S., Bernard, G. R., & Inouye, S. K. (2001b). Evaluation of delirium in critically ill patients: validation of the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU). *Critical Care Medicine*, *29*(7), 1370–1379. https://doi.org/10.1097/00003246-200107000-00012

Ely, E. W., Gautam, S., Margolin, R., Francis, J., May, L., Speroff, T., Truman, B., Dittus, R., Bernard, R., & Inouye, S. K. (2001c). The impact of delirium in the intensive care unit on hospital length of stay. *Intensive Care Medicine*, *27*(12), 1892–1900. https://doi.org/10.1007/s00134-001-1132-2

Ely, E. W., Shintani, A., Truman, B., Speroff, T., Gordon, S. M., Harrell, F. E., Jr, Inouye, S. K., Bernard, G. R., & Dittus, R. S. (2004). Delirium as a predictor of mortality in mechanically ventilated patients in the intensive care unit. *JAMA*, *291*(14), 1753–1762. https://doi.org/10.1001/jama.291.14.1753

Fagundes, J. A., Tomasi, C. D., Giombelli, V. R., Alves, S. C., de Macedo, R. C., Topanotti, M. F., de Lourdes Ugioni Bristot, M., do Brasil, P. E., Soares, M., Salluh, J., Dal-Pizzol, F., & Ritter, C. (2012). CAM-ICU and ICDSC agreement in medical and surgical ICU patients is influenced by disease severity. *PloS One*, *7*(11), e51010. https://doi.org/10.1371/journal.pone.0051010

Gélinas, C., Bérubé, M., Chevrier, A., Pun, B. T., Ely, E. W., Skrobik, Y., & Barr, J. (2018). Delirium assessment tools for use in critically ill adults: a psychometric analysis and systematic review. *Critical Care Nurse*, *38*(1), 38–49. https://doi.org/10.4037/ccn2018633

Gusmao-Flores, D., Salluh, J. I., Chalhub, R. Á., & Quarantini, L. C. (2012). The confusion assessment method for the intensive care unit (CAM-ICU) and intensive care delirium screening checklist (ICDSC) for the diagnosis of delirium: a systematic review and meta-analysis of clinical studies. *Critical Care (London, England)*, *16*(4), R115. https://doi.org/10.1186/cc11407

Hendl, J. (2012). *Přehled statistických metod: analýza a metaanalýza dat* [Overview of statistical methods: data analysis and meta-analysis] (Vol. 7). Portál.

Inouye, S. K., van Dyck, C. H., Alessi, C. A., Balkin, S., Siegal, A. P., & Horwitz, R. I. (1990). Clarifying confusion: the confusion assessment method. A new method for detection of delirium. *Annals of Internal Medicine*, *113*(12), 941–948. https://doi.org/10.7326/0003-4819-113-12-941

Kallert, T. W., Glöckner, M., Onchev, G., Raboch, J., Karastergiou, A., Solomon, Z., Magliano, L., Dembinskas, A., Kiejna, A., Nawka, P., Torres-González, F., Priebe, S., & Kjellin, L. (2005). The EUNOMIA project on coercion in psychiatry: study design and preliminary data. *World Psychiatric*, *4*(3), 168–172.

Kean, J., & Ryan, K. (2008). Delirium detection in clinical practice and research: critique of current tools and suggestions for future development. *Journal of Psychosomatic Research*, *65*(3), 255–259. https://doi.org/10.1016/j.jpsychores.2008.05.024

Koga, Y., Tsuruta, R., Murata, H., Matsuo, K., Ito, T., Ely, E. W., Shintani, A., Wakamatsu, H., Sanui, M., & Yamase, H. (2015). Reliability and validity assessment of the Japanese version of the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU). *Intensive & Critical Care Nursing*, *31*(3), 165–170. https://doi.org/10.1016/j.iccn.2014.10.002

Kose, G., Bolu, A., Ozdemir, L., Acikel, C., & Hatipolu, S. (2016). Reliability and validity of the intensive care delirium screening checklist in Turkish. *International Journal of Nursing Knowledge*, *27*(2), 119–124. https://doi.org/10.1111/2047-3095.12090

Maneewong, J., Maneeton, B., Maneeton, N., Vaniyapong, T., Traisathit, P., Sricharoen, N., & Srisurapanont, M. (2017). Delirium after a traumatic brain injury: predictors and symptom patterns. *Neuropsychiatric Disease and Treatment*, *13*, 459–465. https://doi.org/10.2147/NDT.S128138

Milbrandt, E. B., Deppen, S., Harrison, P. L., Shintani, A. K., Speroff, T., Stiles, R. A., Truman, B., Bernard, G. R., Dittus, R. S., & Ely, E. W. (2004). Costs associated with delirium in mechanically ventilated patients. *Critical Care Medicine*, *32*(4), 955–962. https://doi.org/10.1097/01.ccm.0000119429.16055.92

Mitášová, A., Bednařík, J., Košťálová, M., Michalčáková, R., Ježková, M., Kašpárek, T. Skutilová, S., Straževská, E.,

Šályová, P., Šikolová, V., & Šrámková, L. (2010). Standardizace české verze The Confusion Assessment Method for the Intensive Care Unit (CAM ICUcz). [Standardization of the Czech version of The Confusion Assessment Method for the Intensive Care Unit (CAM-ICUcz)] *Česká a Slovenská Neurologie a Neurochirurgie*, *73/106*(3), 258–266.

Morandi, A., Brummel, N. E., & Ely, E. W. (2011). Sedation, delirium and mechanical ventilation: the 'ABCDE' approach. *Current Opinion in Critical Care*, *17*(1), 43–49. https://doi.org/10.1097/MCC.0b013e3283427243

Plaschke, K., von Haken, R., Scholz, M., Engelhardt, R., Brobeil, A., Martin, E., & Weigand, M. A. (2008). Comparison of the confusion assessment method for the intensive care unit (CAM-ICU) with the Intensive Care Delirium Screening Checklist (ICDSC) for delirium in critical care patients gives high agreement rate(s). *Intensive Care Medicine*, *34*(3), 431–436. https://doi.org/10.1007/s00134-007-0920-8

Terwee, C. B., Bot, S. D., de Boer, M. R., van der Windt, D. A., Knol, D. L., Dekker, J., Bouter, L. M., & de Vet, H. C. (2007). Quality criteria were proposed for measurement properties of health status questionnaires. *Journal of Clinical Epidemiology*, *60*(1), 34–42. https://doi.org/10.1016/j.jclinepi.2006.03.012

Tobar, E., Romero, C., Galleguillos, T., Fuentes, P., Cornejo, R., Lira, M. T., de la Barrera, L., Sánchez, J. E., Bozán, F., Bugedo, G., Morandi, A., & Ely, W. E. (2010). Método para la evaluación de la confusión en la unidad de cuidados intensivos para el diagnóstico de delírium: adaptación cultural y validación de la versión en idioma español [Confusion Assessment Method for diagnosing delirium in ICU patients (CAM-ICU): cultural adaptation and validation of the Spanish version]. *Medicina Intensiva*, *34*(1), 4–13. https://doi.org/10.1016/j.medin.2009.04.003

Tomasi, C. D., Grandi, C., Salluh, J., Soares, M., Giombelli, V. R., Cascaes, S., Macedo, R. C., de Souza Constantino, L., Biff, D., Ritter, C., & Dal Pizzol, F. (2012). Comparison of CAM-ICU and ICDSC for the detection of delirium in critically ill patients focusing on relevant clinical outcomes. *Journal of Critical Care*, *27*(2), 212–217. https://doi.org/10.1016/j.jcrc.2011.05.015

van Eijk, M. M., van Marum, R. J., Klijn, I. A., de Wit, N., Kesecioglu, J., & Slooter, A. J. (2009). Comparison of delirium assessment tools in a mixed intensive care unit. *Critical Care Medicine*, *37*(6), 1881–1885. https://doi.org/10.1097/CCM.0b013e3181a00118

van Eijk, M. M., van den Boogaard, M., van Marum, R. J., Benner, P., Eikelenboom, P., Honing, M. L., van der Hoven, B., Horn, J., Izaks, G. J., Kalf, A., Karakus, A., Klijn, I. A., Kuiper, M. A., de Leeuw, F. E., de Man, T., van der Mast, R. C., Osse, R. J., de Rooij, S. E., Spronk, P. E., van der Voort, P. H., … & Slooter, A. J. (2011). Routine use of the confusion assessment method for the intensive care unit: a multicenter study. *American Journal of Respiratory and Critical Care Medicine*, *184*(3), 340–344. https://doi.org/10.1164/rccm.201101-0065OC

Van Rompaey, B., Schuurmans, M. J., Shortridge-Baggett, L. M., Truijen, S., Elseviers, M., & Bossaert, L. (2009). Long term outcome after delirium in the intensive care unit. *Journal of Clinical Nursing*, *18*(23), 3349–3357. https://doi.org/10.1111/j.1365-2702.2009.02933.x

Vasilevskis, E. E., Chandrasekhar, R., Holtze, C. H., Graves, J., Speroff, T., Girard, T. D., Patel, M. B., Hughes, C. G., Cao, A., Pandharipande, P. P., & Ely, E. W. (2018). The cost of ICU delirium and coma in the intensive care unit patient. *Medical Care*, *56*(10), 890–897. https://doi.org/10.1097/MLR.0000000000000975

Woo, A., & Ratnayake, G. (2020). Sleep and pain management: a review. *Pain Management*, *10*(4), 261–273. https://doi.org/10.2217/pmt-2020-0001

Wild, D., Grove, A., Martin, M., Eremenco, S., McElroy, S., Verjee-Lorenz, A., Erikson, P., & ISPOR Task Force for Translation and Cultural Adaptation (2005). 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 in Health: the Journal of the International Society for Pharmacoeconomics and Outcomes Research*, *8*(2), 94–104. https://doi.org/10.1111/j.1524-4733.2005.04054.x

