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PII: S0033-3182(15)00058-4
DOI: http://dx.doi.org/10.1016/j.psym.2015.03.005
Reference: PSYM538

To appear in: *Psychosomatics*

Cite this article as: Esteban Sepulveda M.D, José G. Franco M.D., M.S., Ph.D, Paula T. Trzepacz M.D, Ana M. Gaviria Ph.D, Eva Viñuelas M.D, José Palma M. D, Gisela Ferré B.S, Imma Grau M.D, Elisabet Vilella Ph.D, Performance of the Delirium Rating Scale Revised–98 Against Different Delirium Diagnostic Criteria in a Population with a High Prevalence of Dementia, *Psychosomatics,* http://dx.doi.org/10.1016/j.psym.2015.03.005

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ABSTRACT

Background: Delirium diagnosis in elderly is often complicated by underlying dementia.

Objective: We evaluated performance of the Delirium Rating Scale-Revised-98 (DRS-R98) in patients with high dementia prevalence and also assessed concordance among past and current diagnostic criteria for delirium.

Methods: Cross-sectional analysis of newly-admitted patients to a skilled nursing facility over 6 months, who were rated within 24-48 hours after admission. Interview for DSM-III-R, DSM-IV, DSM-5, and ICD-10 delirium ratings, administration of the DRS-R98, and assessment of dementia using the Informant Questionnaire on Cognitive Decline in the Elderly were independently performed by 3 researchers. Discriminant analyses (receiver operating characteristics curves) were used to study DRS-R98 accuracy against different diagnostic criteria. Hanley & McNeil test compared the area under the curve (AUC) for DRS-R98's discriminant performance for all diagnostic criteria.

Results: Dementia was present in 85/125 (68.0%) subjects and 36/125 (28.8%) met criteria for delirium by at least one classification system while only 19/36 (52.8%) did by all. DSM-III-R diagnosed the most as delirious (27.2%), followed by DSM-5 (24.8%), DSM-IV-TR (22.4%) and ICD-10 (16%). DRS-R98 had the highest AUC when discriminating DSM-III-R delirium (92.9%), followed by DSM-IV (92.4%), DSM-5 (91%) and ICD-10 (90.5%), without statistical differences among them. The best DRS-R98 cut-off score was ≥14.5 for all diagnostic systems except ICD-10 (≥15.5).

Conclusions: There is a low concordance across diagnostic systems for identification of delirium. The DRS-R98 performs well despite differences across classification systems perhaps because it broadly assesses phenomenology, even in this population with a high prevalence of dementia.

Keywords: Delirium; Dementia; Delirium Rating Scale-Revised-98; Sensitivity and Specificity; Diagnostic and Statistical Manual of Mental Disorders; International Classification of Diseases.

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INTRODUCTION

Phenomenological research reveals delirium has three core domains: attention and other cognitive deficits (orientation, memory, visuospatial ability), higher level thinking disturbances (thought process, language, executive function), and circadian disturbances (sleep-wake cycle, motor activity) that may be variably accompanied by less prevalent psychotic and affective symptoms.[1-5]

Delirium appeared as a diagnostic entity with specific inclusion and exclusion criteria in 1980 in the Diagnostic and Statistical Manual of Mental Disorders, 3rd edition (DSM-III)[6] and has evolved since then including its revision, DSM-III-R.[7] However, DSM-IV (and DSM-IV-TR) eliminated symptoms of circadian domain, and thought process, while preserving attention/cognitive domain and language symptoms.[8,9] The International Classification of Diseases 10th edition (ICD-10) has more detailed research diagnostic criteria,[10] with a more restrictive definition of cognitive dysfunction and the inclusion of disturbances in circadian, but not of higher level thinking domain. Research comparing criteria shows that delirium patient identification differs among them: DSM-IV's simplest criteria have the greatest sensitivity, followed by DSM-III-R and ICD-10.[11,12] These differences make it difficult for clinicians and researchers to rely on any one system as the reference standard.

DSM-5 criteria[13] increased focus on attention and awareness in the cardinal criterion and slightly reorganized some DSM-IV content, but did not add circadian domain and thought process symptoms despite their being core in delirium, ostensibly to make it easier for primary care physicians to diagnose possible delirium. For specialists, however, the DSM-IV and DSM-5 are less specific to delirium due to their greater inclusiveness.[11,12]

The Delirium Rating Scale-Revised-98 (DRS-R98)[14] is a widely employed instrument to evaluate delirium. It was designed to diagnose and evaluate the breadth and severity of delirium symptoms. DSR-R98 was developed based on delirium characteristics rather than any particular (*a priori*) diagnostic system. It has shown very good accuracy against DSM-IV criteria, with very high inter-rater reliability (intra-class correlation coefficient >0.9).

Delirium is common in the elderly, reaching 33% prevalence in long-term care settings and 53.3% in acute geriatric wards.[15,16] Dementia is a predisposing factor for delirium and is often comorbid with it in the elderly though delirium symptoms overshadow dementia when they coexist,[17-23] so dementia poses differential diagnostic challenges for clinicians assessing delirium.

All previous DRS-R98 validation studies have used DSM-IV as the gold standard, and delirium and dementia groups evaluated separately. The objectives of this study were 1) to assess discriminant performance of the Spanish DRS-R98 against DSM-III-R, DSM-IV, DSM-5, and ICD-10 criteria for delirium diagnosis in patients admitted in a skilled nursing facility, with a high prevalence of dementia, and 2) to evaluate concordance among these past and current diagnostic criteria.

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METHODS

Design and Subjects

This is a prospective, cross-sectional study of delirium diagnostic accuracy, designed and reported according to Standards for Reporting of Diagnostic Accuracy guidelines (STARD).[24]

Consecutively admitted patients to a skilled nursing facility (Centro Sociosanitario Monterols, Institut Pere Mata, Tarragona, Spain), were eligible. Patients were admitted from home, general hospital or assisted living/senior community during the 6-month study period. Exclusion criteria were refusal to participate, coma, severe language disorder, or inability to speak Spanish.

This study was approved by our corresponding Institutional Ethics Committee (at Hospital Sant Joan, Reus, Tarragona, Spain). All patients or their proxy, when Mini-mental State Examination (MMSE) score was <24 (routine part of the admission evaluation), gave written informed consent.

Measures

Demographic and clinical data were collected. We also reviewed medical records for a recent diagnosis of delirium.

Charlson Comorbidity Index (Short form; CCI-SF)

Developed from the CCI with similar prognostic value,[25] this version is based on history of 8 medical conditions: cerebrovascular accident, diabetes mellitus, chronic obstructive pulmonary disease, congestive heart failure, dementia, peripheral arterial disease, chronic renal failure and cancer. Each of the first six conditions scores 1 point when present, while each of the 7th and 8th score 2 points if present (for a maximum possible of 10). A CCI-SF score of 0 or 1 indicates no comorbidity, 2 low comorbidity, and ≥3 high comorbidity.

Spanish-Informant Questionnaire on Cognitive Decline in the Elderly (S-IQCODE)

This structured interview is composed by 26 questions to an informant about the patient's cognition and function during the preceding five years. Direct scores range from 26 to 130. The validated Spanish version uses cut-off >85 for possible dementia.[26]

The Delirium Rating Scale Revised-98 (DRS-R98)

The DRS-R98[14] includes phenomenological descriptive anchors to rate severity levels for each item (ranging from 0 to 3), with a maximum DRS-R98 Total scale score of 46 and DRS-R98 Severity scale of 39 points. Its 16 items include three diagnostic items (including acute onset and temporal fluctuation) and 13 items which rate the severity of symptoms, including individual items to evaluate core delirium characteristics: attention, short and long-term memory, visuospatial ability, orientation, sleep-wake cycle disturbances, abnormalities of language and thought process, motor agitation, motor retardation, besides other items evaluating perceptual disturbances, abnormalities in thought content, and affective lability. We used the Spanish version which has very good inter-rater reliability.[27]

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Clinical Diagnostic Criteria

To define delirium status we used four diagnostic criteria: the Diagnostic and Statistical Manual of Mental Disorders-5, IV and III-Revised editions (DSM-5, DSM-IV and DSM-III-R),[7,8,13] and the International Classification of Diseases 10th edition for research (ICD-10).[10] We designed a diagnostic criteria checklist to systematically rate each item for all diagnostic criteria dichotomously (as present or not) in order to ensure their complete evaluation.

Procedures

Two trained researchers independently evaluated all subjects 24 to 48 hours after admission to rate the Spanish DRS-R98 and the delirium diagnostic criteria checklist, each covering the preceding 24 hours using all sources of information. A third researcher contacted the family or caregiver to administer the S-IQCODE.

Statistical analysis

Continuous variables are expressed as means ± standard deviation (SD). Chi-square test compared categorical variables (with continuity correction as appropriate) and t test compared continuous variables. Statistical significance was set at $p<0.05$, except for multiple comparisons of DRS-R98 items where p was set at <0.01.

DRS-R98 accuracy, sensitivity, specificity and optimal cut-off scores were obtained with receiver operating characteristic curve (ROC) analysis of the area under the curve (AUC) for the whole sample and for those with dementia, reported with their corresponding standard error (SE). Hanley & McNeil test compared the AUCs for DRS-R98's discriminant performance for diagnostic criteria.

Data were analysed using SPSS 21.0, and Epidat 3.01 (ROC analysis, comparison of AUC, and corresponding graphics). The overlap of the diagnostic criteria is reported with a Venn diagram created on VENNY online program.[28]

RESULTS

Sample Characteristics

Of 141 patients admitted during the study period, 16 were excluded, leaving a sample of 125 participants (see Figure 1 for STARD flow diagram). Mean age was 78.73±9 years and 50.4% were women. Table 1 shows demographic and clinical characteristics by delirium and nondelirium groups according to DSM-5 criteria for the whole sample and the subsample with dementia. The delirium group was significantly older and had higher dementia prevalence.

Delirium Diagnosis by Classification Systems

The Venn diagram (Figure 2) shows that 36/125 patients (28.8%) met criteria for delirium by at least one classification system, but only 19/36 (52.8%) met all four criteria which is a low concordance across the classification systems. The most subjects were diagnosed as delirious (27.2%) by DSM-III-R, followed by DSM-5 (24.8%), DSM-IV (22.4%) and ICD-10 (16%). DSM-III-R had the most cases (14.7%) that did not overlap with any other diagnostic classification, yet almost all (34/36) of the delirium cases diagnosed using any system met DSM-III-R criteria

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showing its inclusiveness. Almost all of the 20/36 ICD-10 delirium cases overlapped with all other systems (19/20).

Dementia

Possible preexisting dementia (S-IQCODE score >85) occurred in 85 (68%). There was no difference in age (79.89±7.90 vs. 76.25±10.90, t =-1.894, p =0.063) between those with and without dementia. Those with dementia had more medical comorbidity (CCI-SF score 2.07±1.4 vs. 1.48±1.3; t =-2.245, p =0.027) and more frequent use of atypical antipsychotics (45.9% vs. 17.5%, χ^2 =9.421, p =0.002) than those without dementia.

Dementia patients had a significantly higher occurrence of delirium according to all four diagnostic criteria when compared to those without dementia. Using DSM-5, it was 30.6% vs. 12.5% (χ^2 =4.772, p =0.029), ICD-10 21.2% vs. 5% (χ^2 =5,296, p =0.021), DSM-III-R 35.3% vs. 10% (χ^2 =8.788, p =0.003), and DSM-IV 28.2% vs. 10% (χ^2 =5.203, p =0.023) when comparing dementia vs. nondementia groups.

DRS-R98 scores

Mean DRS-R98 Total score for DSM-5 was 22.48±7.71 (range 5-38) in the delirium vs. 7.91±7.02 (range 0-30) in nondelirium group. Similarly, for ICD-10, mean DRS-R98 Total was 23.75±6.60 (range 15-38) vs. 9.20±8.18 (range 0-32); for DSM-III-R, 22.62±7.52 (range 5-38) vs. 7.38±6.44 (range 0-30); and for DSM-IV, 23.50±7.39 (range 5-38) vs. 8.07±6.99 (range 0-30).

There were significant differences (p ≤0.01) in mean values of almost all DRS-R98 items (except for items #2 and 3 representing psychosis), for DRS-R98 Total scores, and in Severity scale scores between subjects with and without delirium according to all diagnostic systems in the whole sample (data not shown). Table 2 shows mean values for DRS-R98 items and Total scale scores for groups with and without delirium in the dementia subsample. Items evaluating the three core domains of delirium had higher mean scores in dementia patients with delirium than nondelirium, but no differences for non-core psychotic and affective items. Mean scores for items representing the circadian domain (sleep-wake cycle, motor disturbances), higher level thinking (language, thought process), and the cognitive domain (attention, visuospatial ability, orientation, memory) as well as diagnostic characteristics (temporal onset, fluctuation, presence of a medical cause) generally had high significance (p <0.01) irrespective of the delirium diagnostic criteria used.

ROC Analyses Using DRS-R98

ROC curve analysis (Figure 3) showed very good discriminant capacity using AUC for the DRS-R98 Total scale for delirium diagnosed using all four systems. AUC was highest for DSM-III-R (92.92%) followed by DSM-IV, DSM-5 and ICD-10, but there was no statistical difference for AUC among them, whether tested for the whole sample or the dementia subsample.

Sensitivity and specificity values for various cut-off scores of the DRS-R98 Total scale are shown for the whole sample in Table 3 and for dementia subsample in Table 4. Selected highest values that balanced sensitivity and specificity for each criteria system are shown in

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shaded rows. Best cut-off score for the DRS-R98 Total was ≥14.5 for all systems except ICD-10 (≥15.5), for both all subjects and the subsample.

Using these best DRS-R98 cut-offs from ROC analysis in the whole sample, sensitivity values from highest to lowest were: DSM-IV, DSM-III-R, DSM-5 and ICD-10. Similarly, specificity values were ranked from highest to lowest as DSM-III-R, DSM-5, DSM-IV, and then ICD-10. In the subsample of patients with dementia the order from higher to lower sensitivity at the best cut-offs from ROC analysis was DSM-IV, DSM-III-R, DSM-5 and ICD-10, and the order from higher to lower specificity was DSM-III-R, ICD-10 and DSM-5 with the same score, and DSM-IV. If we use 14.5 as the cut-off score for ICD-10, as for the other criteria, sensitivity increased up to 100% but specificity worsens.

Figure 4 compares DRS-R98 Total AUC between groups with and without dementia. The discriminant capacity of the tool was lower in the dementia subsample than in the whole sample, irrespective of the diagnostic criteria used ($p < 0.03$ for all Hanley & McNeil tests χ^2). Similar findings were found for the DRS-R98 Severity scale (not shown in the figure, $p > 0.02$ for all Hanley & McNeil tests χ^2).

DISCUSSION

We present new data on performance of the DRS-R98 when evaluated against four major delirium diagnostic systems in subjects admitted to a skilled nursing facility that had a high prevalence of preexisting dementia. There was poor concordance for delirium diagnosis among the criteria systems. Despite this, the DRS-R98 scale had high discriminant capacity for delirium diagnosis irrespective of the classification system. Using ROC analyses, AUCs for delirium diagnosis ranged from 90.5% (ICD-10) to 92.9% (DSM-III-R) for the whole sample and were somewhat lower for the dementia subsample where AUCs ranged from 86.7% (ICD-10) to 88.5% (DSM-III-R). Balancing sensitivity and specificity values for each diagnostic system to determine the best DRS-R98 cutoff value, all DSM criteria versions had the same value (≥14.5), while the cutoff for ICD-10 was slightly higher (≥15.5). DRS-R98 showed higher sensitivity for DSM criteria than for ICD-10 at the recommended cut-offs, with DSM-IV having the highest, followed by DSM-III-R, and the new DSM-5. Specificity was higher using DSM-III-R followed by DSM-5, DSM-IV, and ICD-10 with almost the same value for those three.

According to Kendler (2009), inclusion of both current and historical delirium criteria in our analysis is important because a defining feature of a mature science is its cumulative nature and capacity to build on what has gone before. In this sense, evolution of psychiatric criteria could be understood as an iterative process that should increase quality of clinical diagnosis.[29] So, lessons can be learned from quantifying concordance among the evolving delirium criteria and analyzing against them the performance of a tool like DRS-R98 that assesses the wide range of core and non-core phenomenological characteristics of the syndrome.

There was a strikingly low concordance for identification of delirium subjects by all four approaches (around 50%). The phenomenological breadth and depth of criteria varies considerably, with DSM-III-R involving more symptoms than either DSM-IV or DSM-5 that were

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designed to be less restrictive. The number of delirium cases identified individually by each system also varied considerably (20 for ICD-10, 28 for DSM-IV, 31 for DSM-5, and 34 for DSM-III-R) with the ICD-10 being most restrictive (see Venn diagram in Figure 2). Therefore, one major challenge in evaluating the performance of the DRS-R98 – or any tool for that matter – against a gold standard is when the diagnostic criteria vary so much across the DSM and ICD systems when applied to a given person that one must question which, if any, are truly a gold standard. Certainly we have learned in the field of Alzheimer's dementia that using clinical or research diagnostic criteria is not well validated to neuropathological diagnosis on autopsy,[30] thereby making any clinical diagnosis-based standard less than "golden." This is probably the case in delirium where we need biomarker validation in conjunction with the clinical criteria to ascertain true cases. Biomarker research in delirium is lagging though an electrophysiological approach may have the best chance of success were it available in a portable method.

In line with previous studies,[11,12,31] we found ICD-10 had the least inclusive criteria due to its requirements for more detailed symptoms though it still does not evaluate all 3 core domains of delirium.[2,5,32] In fact, the high DRS-R98 mean scores of almost 24 in delirium and around 9 in nondelirium according to ICD-10 suggests it captures more full syndromal delirium and fewer subsyndromal cases than do the DSM systems. DSM-III-R diagnosed more patients in our study, even though it incorporates more symptoms than the DSM-IV, similar to the report of Laurila et al. (2003) who found DSM-III-R more inclusive in nursing home patients.[11] On the other hand, DRS-R98 had the highest specificity when compared to DSM-III-R criteria, so it could also be possible that the greater inclusiveness of DSM-III-R better approximates the true prevalence of delirium and could be attributable to its inclusion (though not all required) of symptoms from all three delirium core domains, in particular circadian disturbances of sleep-wake cycle and motor activity and disorganized thinking. Other classifications rely on attention deficits and omit or do not require many symptoms that are considered core for the syndrome.[2,4,5,31,32] Because of the breadth of types of symptoms that can occur in delirium, it might be that even a more comprehensive listing of symptoms in DSM-5 could enhance the possibility of diagnosis.

The best cut-off values for the DRS-R98 when assessing DSM criteria (14.5) are the same as those reported in the validation against DSM-IV of the Japanese version[33] and relatively similar to those of the Chinese version vs. DSM-IV (15.5)[34] though the Colombian version vs. DSM-IV was a little lower (12.0).[35] Our values are lower than those in the original English version against DSM-IV (17.75),[14] Portuguese version vs. DSM-IV (20.1),[36] and Korean version vs. DSM-IV (18.5–19.5)[37] validation studies. Differences among studies in cut-off scores could be a consequence of differences in socio-demographical and clinical characteristics of the sample.

We chose the study sample from a skilled nursing facility, and to have a high comorbidity of dementia because this is a challenge to clinicians in diagnosing delirium. Specific DRS-R98 items representing the three core delirium domains, as well as diagnostic characteristics, particularly distinguished delirium in the subgroup of dementia patients. More research is needed as to whether clinicians can rely on those features to detect delirium in dementia patients.

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Strengths of this study include independent research ratings for classification systems checklists, and DRS-R98. We used medical records, history-taking, family/carer interview and IQCODE to diagnose pre-existing dementia though this is less rigorous than a complete dementia evaluation. We also did not specify the type of dementia or its severity. Because different types of dementia (e.g. Alzheimer's, vascular, Lewy Body, Frontotemporal) have their own phenomenological patterns, the detection using a delirium-designed tool (DRS-R98) may have been affected somewhat, including our finding of higher mean DRS-R98 Total scores in the nondelirium cases with dementia than in the whole sample that included nondementia patients, suggesting dementia symptoms contribute to the scale scores in a fashion that could reduce the scales' ability to discriminate. Nonetheless, the ROC analyses were similar irrespective of presence of dementia or not; moreover, DRS-R98 items evaluating diagnostic characteristics and symptoms from delirium core domains showed differentiation of delirium from non-delirium among patients with dementia.

In summary, DRS-R98 proved to be a valid and useful instrument for assessing/discriminating delirium in post-acute elderly patients in the skilled nursing home setting, regardless of the inclusiveness of diagnostic system used. Furthermore, it proved to be a valid tool to diagnose delirium in patients with a previous dementia, where the performance of diagnostic criteria is lower. Besides consideration of biomarkers, further evolution of delirium diagnostic criteria should take into account symptoms representing the three core domains so that delirium could be assessed in a more specific way in order to better distinguish full syndromal from subsyndromal and nondelirium cases even in those with dementia.

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Disclosures

There was no formal funding for this study.

Dr. Trzepacz is a retired employee and minor shareholder at Eli Lilly and Company. Dr. Trzepacz holds the copyright for the Delirium Rating Scale-Revised-98 but does not charge a fee for a not-for-profit use. All other coauthors report no proprietary or commercial interest in any product mentioned or concept discussed in this article.

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Table 1. Demographic and clinical characteristics according to diagnosis groups. Delirium cases are reported as diagnosed according to DSM-5 diagnostic criteria. Data shown as means ± SD unless denoted by frequencies (percents). Comparisons are between delirium and nondelirium participants.

	Whole sample		Subsample with dementia	
Variable	**Nondelirium (n= 94)**	**Delirium (n= 31)**	**Nondelirium (n= 59)**	**Delirium (n= 26)**
Age	77.11±9.16	83.65±6.91*	78.34±7.62	83.42±7.50*
Education (years)	4.93±3.95	4.35±4.44	4.20±3.34	4.19±4.49
Charlson comorbidity score	1.85±1.43	1.97±1.33	2.05±1.43	2.12±1.40
Sex (%)				
Men	44 (46.8)	18 (58.1)	25 (42.4)	15 (57.7)
Women	50 (53.2)	13 (41.9)	34 (57.6)	11 (42.3)
Marital status (%)				
Single	10 (10.6)	4 (12.9)	3 (5.1)	3 (11.5)
Stable partnership	34 (36.2)	16 (51.6)	22 (37.3)	13 (50.0)
Separated / Divorced	9 (9.6)	1 (3.2)	6 (10.2)	1 (3.8)
Widowed	41 (43.6)	10 (32.3)	28 (47.5)	9 (34.6)
Occupational status (%)				
Employed	1 (1.1)	-	1 (1.7)	-
Homemaker	3 (3.2)	-	1 (1.7)	-
Retired	42 (44.7)	21 (67.7)	27 (45.8)	17 (65.4)
Pensioner (other)	46 (48.9)	10 (32.3)	30 (50.8)	9 (34.6)
Unemployed	2 (2.1)	-	-	-
Possible Dementia† (%)	59 (62.8)	26 (83.9)*	N/A	N/A
Medications used‡ (%)				
Anticholinergics	39 (41.5)	15 (48.4)	24 (40.7)	12 (46.2)
Typical Antipsychotics	6 (6.4)	3 (9.7)	5 (8.5)	2 (7.7)
Atypical Antipsychotics	29 (30.9)	17 (54.8)*	24 (40.7)	15 (57.7)
Benzodiazepines	37 (39.4)	16 (51.6)	26 (44.1)	14 (53.8)
Cognitive enhancers	8 (8.5)	1 (3.2)	7 (11.9)	1 (3.8)
Five most common main diagnoses at admission (%)				
Dementia	16 (17.0)	9 (29.0)	15 (25.4)	9 (34.6)
Convalescence for fracture:				
Hip / Femur fracture	13 (13.8)	3 (9.7)	8 (13.6)	3 (11.5)
Other types	10 (10.6)	2 (6.5)	5 (8.5)	1 (3.8)
Psychiatric diagnosis	12 (12.8)	-	11 (18.6)	-*
Cerebrovascular disease	6 (6.4)	6 (19.4)	4 (6.8)	4 (15.4)
Systemic infection	6 (6.4)	5 (16.1)	4 (6.8)	5 (19.2)
Previous diagnosis of delirium§	13 (13.8)	12 (38.7)*	10 (16.9)	10 (38.5)
DRS-R98 Total Score	7.91±7.02	22.48±7.71*	10.78±7.09	22.96±7.72*

* $p < 0.05$.

† S-IQCODE >85.

‡ During 24h before evaluation.

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[§] As reported in clinical records.

N/A: Not applicable.

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Table 2. Comparison of DRS-R98 individual item (mean ± SD) in 85 hospitalized dementia patients with or without delirium according to different DSM and ICD criteria. Significant differences at p <0.01 for t tests are bolded.

	DSM-5		ICD-10		DSM-III-R		DSM-IV	
	No delirium (n =59)	Delirium (n =26)	No delirium (n =67)	Delirium (n =18)	No delirium (n =55)	Delirium (n =30)	No delirium (n =61)	Delirium (n =24)
DRS-R98 Item								
1. Sleep-wake cycle disturbance	**0.61±0.67**	**1.73±0.67**	**0.72±0.75**	**1.83±0.51**	**0.60±068**	**1.60±0.72**	**0.66±0.70**	**1.71±0.69**
2. Perceptions and hallucinations	0.56±1.10	0.62±1.02	0.55±1.06	0.67±1.03	0.53±1.07	0.67±1.03	0.59±1.10	0.54±0.93
3. Delusions	0.76±1.16	0.38±0.85	0.67±1.12	0.56±0.98	0.80±1.19	0.37±0.81	0.74±1.15	0.42±0.88
4. Lability of affect	0.36±0.55	0.69±0.79	0.37±0.57	0.78±0.81	0.36±0.56	0.63±0.76	0.36±0.55	0.71±0.81
5. Language	**0.54±0.86**	**1.42±1.10**	**0.66±0.95**	**1.39±1.09**	**0.42±0.71**	**1.53±1.11**	**0.54±0.85**	**1.50±1.10**
6. Thought process abnormalities	**0.69±0.81**	**1.46±1.10**	0.82±0.90	1.33±1.14	**0.62±0.73**	**1.50±1.11**	**0.69±0.81**	**1.54±1.10**
7. Motor agitation	**0.36±0.66**	**1.12±0.86**	**0.37±0.67**	**1.39±0.78**	**0.27±0.59**	**1.17±0.83**	**0.36±0.66**	**1.17±0.87**
8. Motor retardation	**0.39±0.69**	**1.50±1.03**	**0.60±0.91**	**1.22±1.00**	**0.42±0.71**	**1.30±1.09**	**0.39±0.69**	**1.58±1.02**
9. Orientation	**1.20±0.89**	**2.15±0.73**	**1.30±0.92**	**2.22±0.65**	**1.11±0.83**	**2.20±0.71**	**1.21±0.88**	**2.21±0.72**
10. Attention	**0.63±0.74**	**2.04±0.87**	**0.79±0.90**	**2.06±0.80**	**0.62±0.73**	**1.87±0.97**	**0.64±0.73**	**2.13±0.85**
11. Short-term memory	**0.41±0.91**	**1.19±1.02**	**0.49±0.94**	**1.22±1.06**	**0.33±0.79**	**1.23±1.10**	**0.43±0.90**	**1.21±1.06**
12. Long-term memory	1.93±1.03	2.50±0.95	**1.93±1.06**	**2.78±0.55**	**1.82±1.06**	**2.63±0.76**	**1.92±1.05**	**2.58±0.83**
13. Visuospatial ability	**0.86±1.02**	**2.15±1.08**	**1.00±1.13**	**2.22±0.94**	**0.73±0.93**	**2.23±1.01**	**0.85±1.01**	**2.29±1.00**
14. Temporal onset of symptoms	**0.64±0.74**	**1.50±0.71**	**0.72±0.75**	**1.61±0.70**	**0.65±0.75**	**1.37±0.76**	**0.66±0.73**	**1.54±0.72**
15. Fluctuation of symptom severity	**0.22±0.46**	**1.00±0.49**	**0.28±0.49**	**1.11±0.47**	**0.20±0.45**	**0.93±0.52**	**0.25±0.47**	**1.00±0.51**
16. Physical disorder	**0.61±0.74**	**1.50±0.58**	**0.70±0.78**	**1.56±0.51**	**0.60±0.76**	**1.40±0.62**	**0.62±0.73**	**1.54±0.59**
DRS-R98 Total score	**10.78±7.09**	**22.96±7.72**	**11.97±8.03**	**23.94±6.81**	**10.07±6.55**	**22.63±7.67**	**10.90±7.03**	**23.67±7.55**

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Table 3. Sensitivity and specificity for delirium diagnosis of the DRS-R98 Total scale, according to each diagnostic classification criteria, for 125 consecutive patients admitted to a skilled nursing facility. Shaded areas correspond to the best cut-off scores sensibility and specificity values, for each diagnostic system.

	DSM-5 Criteria		ICD-10 Criteria		DSM-III-R Criteria		DSM-IV Criteria	
Cut-off	Sensitivity (%)	Specificity (%)	Sensitivity (%)	Specificity (%)	Sensitivity (%)	Specificity (%)	Sensitivity (%)	Specificity (%)
4.50	100	38.3	100	34.3	100	39.6	100	37.1
5.50	96.8	46.8	100	42.9	94.1	47.3	96.4	45.4
6.50	96.8	58.5	100	53.3	94.1	59.3	96.4	56.7
7.50	96.8	61.7	100	56.2	94.1	62.6	96.4	59.8
8.50	96.8	68.1	100	61.9	94.1	69.2	96.4	66.0
9.50	96.8	69.1	100	62.9	94.1	70.3	96.4	67.0
10.50	93.5	69.1	100	63.8	94.1	71.4	96.4	68.0
11.50	90.3	72.3	100	67.6	94.1	75.8	96.4	72.2
12.50	90.3	74.5	100	69.5	94.1	78.0	96.4	74.2
13.50	90.3	79.8	100	74.3	94.1	83.5	96.4	79.4
14.50	90.3	84.0	100	78.1	94.1	87.9	96.4	83.5
15.50	77.4	87.2	90.0	82.9	82.4	91.2	82.1	86.6
16.50	74.2	89.4	85.0	84.8	79.4	93.4	78.6	88.7
17.50	71.0	89.4	80.0	84.8	76.5	93.4	75.0	88.7
18.50	61.3	90.4	65.0	85,7	67.6	94.5	67.9	90.7
19.50	61.3	91.5	65.0	86.7	64.7	94.5	67.9	91.8
20.50	58.1	92.6	60.0	87.6	61.8	95.6	64.3	92.8
22.50	54.8	94.7	60.0	90.5	52.9	95.6	60.7	94.8
24.50	48.4	95.7	50.0	91.4	47.1	96.7	53.6	95.9
25.50	41.9	96.8	40.0	92.4	41.2	97.8	46.4	96.9
26.50	29.0	96.8	30.0	94.3	29.4	97.8	32.1	96.9
27.50	22.6	97.9	20.0	95.2	20.6	97.8	25.0	97.9
29.00	22.6	98.9	20.0	96.2	20.6	98.9	25.0	99.0
30.50	16.1	100	15.0	98.1	14.7	100	17.9	100
31.50	9.7	100	10.0	99.0	8.8	100	10.7	100
33.50	6.5	100	10.0	100	5.9	100	7.1	100

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Table 4. Sensitivity and specificity for delirium diagnosis of the DRS-R98 Total scale, according to each diagnostic classification criteria, for the subsample of 85 patients with dementia (S-IQCODE >85), from a skilled nursing facility. Shaded areas correspond to the best cut-off scores sensibility and specificity values, for each diagnostic system.

	DSM-5		ICD-10		DSM-III-R		DSM-IV	
Cut-off	Sensitivity (%)	Specificity (%)	Sensitivity (%)	Specificity (%)	Sensitivity (%)	Specificity (%)	Sensitivity (%)	Specificity (%)
4.50	100	13.6	100	11.9	100	14.5	100	13.1
5.50	96.2	22.0	100	20.9	93.3	21.8	95.8	21.3
6.50	96.2	40.7	100	37.3	93.3	41.8	95.8	39.3
7.50	96.2	45.8	100	41.8	93.3	47.3	95.8	44.3
9.50	96.2	54.2	100	49.3	93.3	56.4	95.8	52.5
11.50	92.3	59.3	100	55.2	93.3	63.6	95.8	59.0
12.50	92.3	61.0	100	56.7	93.3	65.5	95.8	60.7
13.50	92.3	69.5	100	64.2	93.3	74.5	95.8	68.9
14.50	92.3	74.6	100	68.7	93.3	80.0	95.8	73.8
15.50	80.8	79.7	88.9	74.6	83.3	85.5	83.3	78.7
16.50	76.9	83.1	83.3	77.6	80.0	89.1	79.2	82.0
17.50	73.1	83.1	77.8	77.6	76.7	89.1	75.0	82.0
18.50	65.4	84.7	66.7	79.1	70.0	90.9	70.8	85.2
19.50	65.4	86.4	66.7	80.6	66.7	90.9	70.8	86.9
20.50	61.5	88.1	61.1	82.1	63.3	92.7	66.7	88.5
22.50	57.7	91.5	61.1	86.6	53.3	92.7	62.5	91.8
24.50	50.0	93.2	50.0	88.1	46.7	95.5	54.2	93.4
25.50	42.3	94.9	38.9	89.6	40.0	96.4	45.8	95.1
26.50	30.8	94.9	33.3	92.5	30.0	96.4	33.3	95.1
27.50	23.1	96.6	22.2	94.0	20.0	96.4	25.0	96.7
29.00	23.1	98.3	22.2	95.5	20.0	98.2	25.0	98.4
30.50	15.4	100	16.7	98.5	13.3	100	16.7	100
31.50	11.5	100	11.1	98.5	10.0	100	12.5	100
33.50	7.7	100	11.1	100	6.7	100	8.3	100

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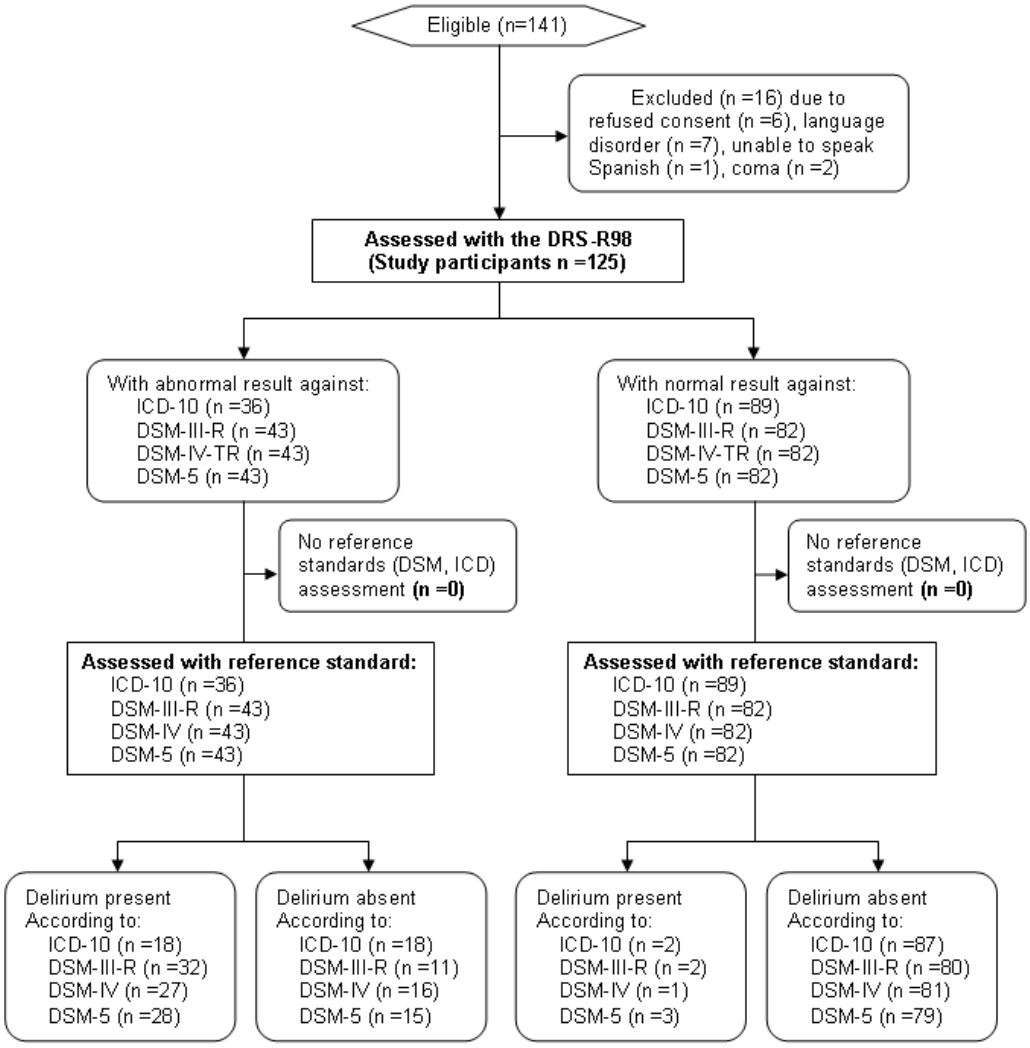
Fig 1



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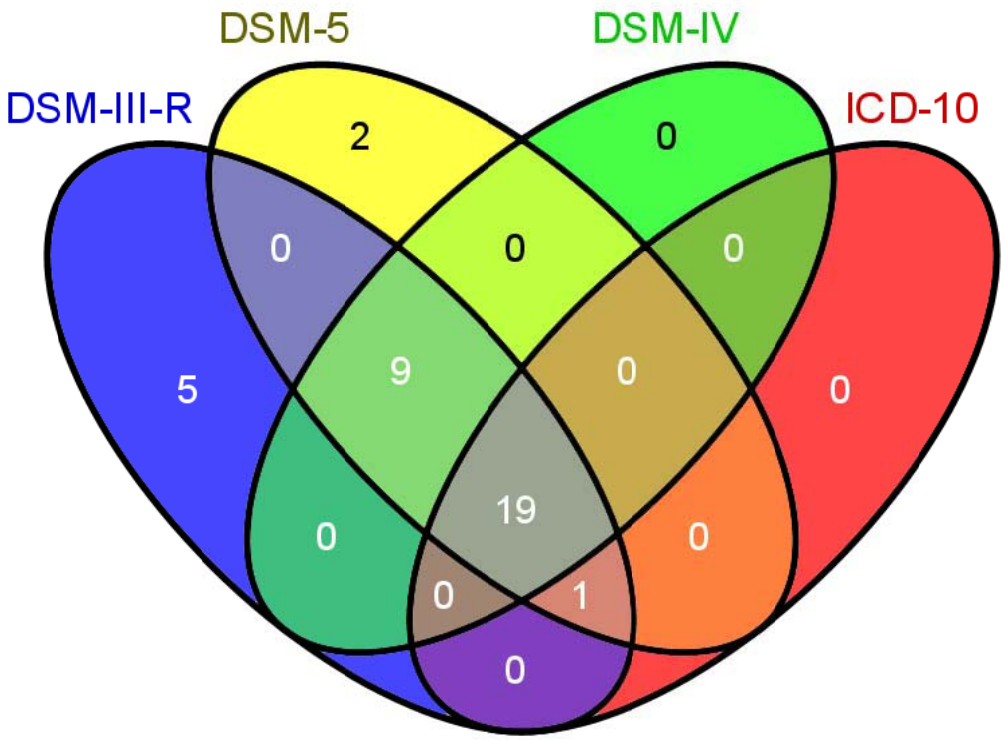

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Fig 3

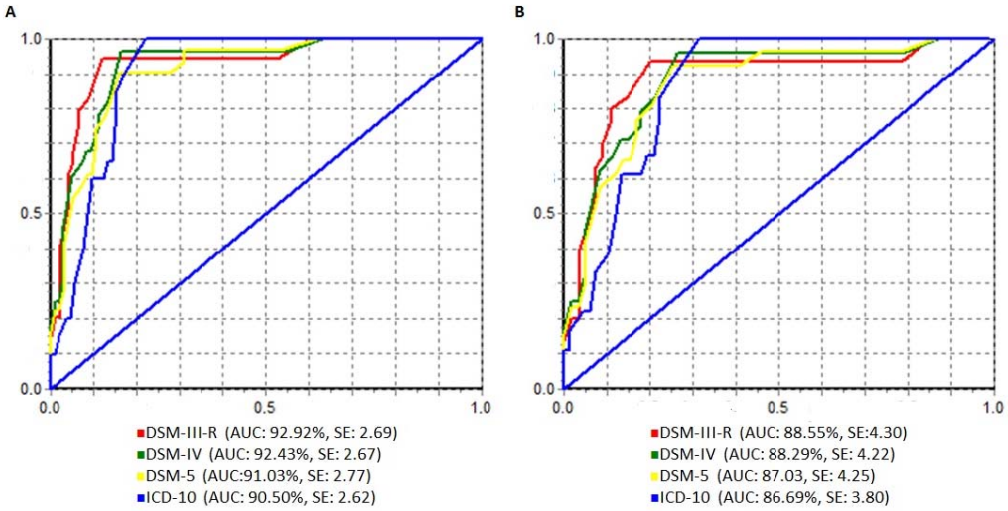

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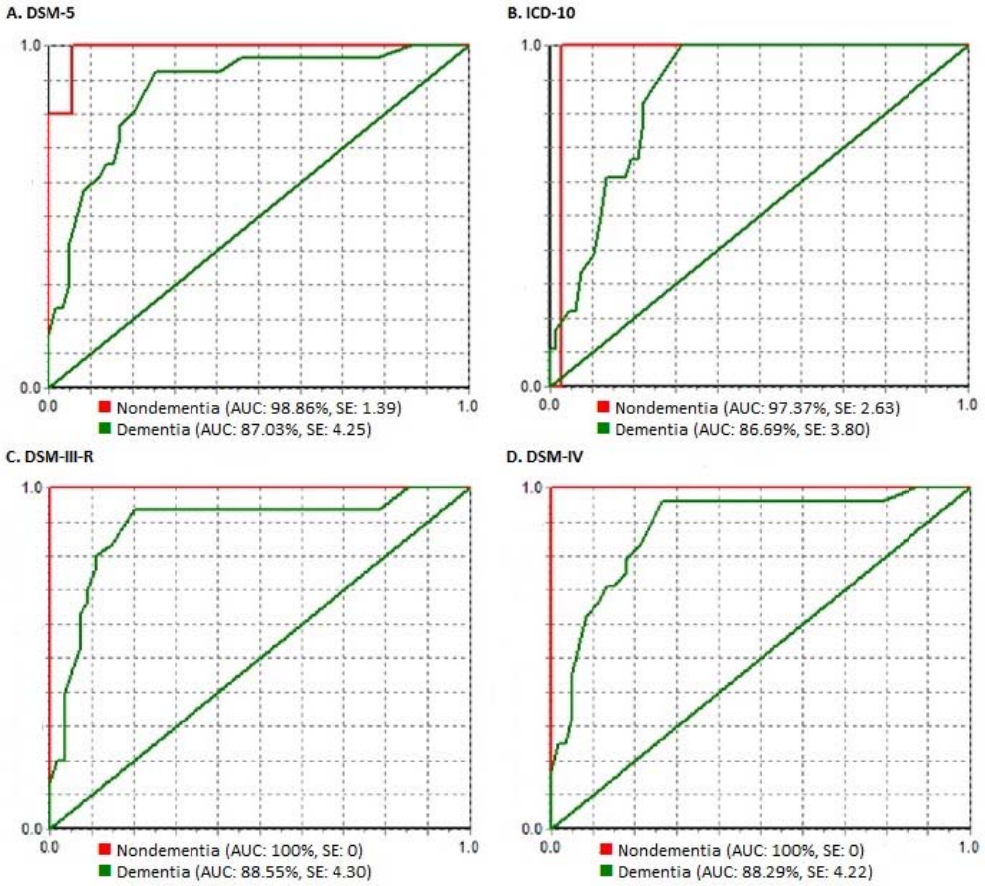
Fig 4



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