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Neurocognitive Disorders and Their Relationship with Major Depressive Disorder: A Cross-Sectional Study at a Psychiatric Hospital in Maracaibo, Venezuela

Trastornos neurocognitivos y su relación con el trastorno depresivo mayor: un estudio transversal en un hospital psiquiátrico de Maracaibo, Venezuela

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SUMMARY

Background: *Neurocognitive disorders and major depressive disorders (MDD) frequently co-occur in older adults and complicate diagnosis and management in psychiatric settings.*
Objective: *To assess the association between depression severity, cognitive impairment, and cognitive distortion patterns in patients treated at the Psychiatric Hospital of Maracaibo, Venezuela.*
Material and methods. *Cross-sectional correlational study (November 2023 to October 2024) including 100 patients aged 54 to 82 years with depressive disorder (DSM-5-TR). Depression severity was measured with the Beck Depression Inventory (BDI), cognition with the Mini-Mental State Examination (MMSE), and cognitive distortions with the Ruiz and Luján Automatic Thoughts Inventory. Key associations are reported with effect estimates and 95 % confidence intervals (CIs).*
Results: *Depression severity was moderate in 55 % (55/100), severe in 35 % (35/100), and mild in 10 % (10/100). Cognitive impairment (MMSE < 24) was present in 63 % (63/100; 95 % CI 52.8 to 72.4). Cognitive impairment was more frequent in severe than non-severe depression (94.3 % vs 46.2 %), with PR 2.04 (95 % CI 1.55 to 2.69). MMSE scores decreased with increasing depression severity. In cognitive distortions, severe depression showed higher scores across multiple domains; for example, "fallacy of change" was higher in severe versus moderate depression (standardized mean difference, Hedges g 2.07; 95 % CI 1.55 to 2.60).*
Conclusion: *In this hospital-based sample, greater depression severity was associated with higher prevalence of cognitive impairment and higher cognitive distortion scores. These findings support integrated assessment of mood and cognition and motivate longitudinal studies to clarify temporal trajectories.*

Keywords: *Neurocognitive disorders, major depressive disorder, cognitive impairment, elderly, mental health.*

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RESUMEN

Introducción: *Los trastornos neurocognitivos y el trastorno depresivo mayor (TDM) coexisten con frecuencia en adultos mayores y complican el diagnóstico y el manejo en entornos psiquiátricos.*
Objetivo: *Evaluar la asociación entre la gravedad de la depresión, el deterioro cognitivo y los patrones de distorsión cognitiva en pacientes atendidos en el Hospital Psiquiátrico de Maracaibo, Venezuela.*
Materiales y métodos: *Estudio transversal correlacional (de noviembre de 2023 a octubre de 2024) que incluyó a 100 pacientes de 54 a 82 años con trastorno depresivo (DSM-5-TR). La gravedad de la depresión se midió con el Inventario de Depresión de Beck (BDI), la cognición con el Mini-Examen del Estado Mental (MMSE) y las distorsiones cognitivas con el Inventario de Pensamientos Automáticos de Ruiz y Luján. Las asociaciones clave se reportan mediante estimaciones de efecto con un intervalo de confianza (IC) del 95 % (IC).*
Resultados: *La gravedad de la depresión fue moderada en el 55 % (55/100), severa en el 35 % (35/100) y leve en el 10 % (10/100). El deterioro cognitivo (MMSE < 24) se observó en el 63 % (63/100; IC 95 %: 52,8 a 72,4). El deterioro cognitivo fue más frecuente en depresión severa que en depresión no severa (94,3 % vs 46,2 %), con una RP de 2,04 (IC 95 %: 1,55 a 2,69). Los puntajes de MMSE disminuyeron a medida que aumentó la gravedad de la depresión. En las distorsiones cognitivas, la depresión severa mostró puntajes más altos en múltiples dominios; por ejemplo, la "falacia de cambio" fue mayor en la depresión severa que en la moderada (diferencia de medias estandarizada, g de Hedges: 2,07; IC 95 %: 1,55 a 2,60).*
Conclusiones: *En esta muestra hospitalaria, una mayor gravedad de la depresión se asoció con una mayor prevalencia de deterioro cognitivo y con puntajes más altos de distorsiones cognitivas. Estos hallazgos respaldan una evaluación integrada del estado de ánimo y de la cognición, y motivan estudios longitudinales para aclarar las trayectorias temporales.*

Palabras clave: *Trastornos neurocognitivos, trastorno depresivo mayor, deterioro cognitivo, adulto mayor, salud mental.*

INTRODUCTION

The global aging population has brought increased attention to the complex interplay between neurocognitive disorders and major depressive disorder (MDD) in older adults. This relationship represents a significant public health challenge, particularly in Latin American countries where rapid demographic transitions are occurring alongside limited mental health infrastructure (1). Depression affects approximately 5 % of adults globally according to the World Health Organization (WHO), with substantially higher rates observed in elderly populations, particularly those with concurrent medical conditions (2).

The bidirectional relationship between depression and cognitive decline has been extensively documented in the literature. Yet, the specific mechanisms and patterns of this association remain incompletely understood, particularly in developing country contexts (3). Late-life depression has been associated with an increased risk of developing neurocognitive disorders, with studies suggesting that depressive episodes in older adults can affect cognitive functions, including memory, sustained and divided attention, decision-making, and information processing speed (4). Furthermore, structural brain changes, including cerebral atrophy and white matter alterations, have been observed with greater prevalence in patients with late-onset depression, reinforcing the concept that depression in advanced age represents a significant risk factor for the development of neurocognitive disorders within two to five years (5).

The pathophysiology underlying this relationship is multifactorial and complex. Biological factors include alterations in neurotransmitter systems, particularly involving serotonin, norepinephrine, and dopamine pathways (6). Chronic stress and inflammation have been implicated in both depression and cognitive decline, with elevated cortisol levels and pro-inflammatory cytokines potentially mediating the relationship between these conditions (7). Additionally, vascular factors play a crucial role, particularly in late-onset depression, where subcortical white matter lesions are commonly observed and associated with both depressive symptoms and cognitive impairment (8).

From a clinical perspective, the co-occurrence of depression and cognitive impairment presents

significant diagnostic and therapeutic challenges. The concept of "pseudodementia" or depression-related cognitive impairment has evolved, with current understanding suggesting that cognitive deficits associated with depression may represent both a consequence of mood disorder and a risk factor for future dementia (9). This complexity underscores the importance of comprehensive assessment approaches that can differentiate between primary neurocognitive disorders and cognitive symptoms secondary to depression, while also recognizing their frequent co-occurrence.

The sociodemographic context significantly influences the presentation and progression of both conditions. Factors such as educational attainment, socioeconomic status, social support networks, and access to healthcare services all play crucial roles in determining outcomes (10). In Latin American populations, these factors are particularly relevant given the high levels of social inequality, limited access to specialized mental health services, and cultural factors that may influence help-seeking behaviors and symptom expression (11).

Venezuela presents a unique context for studying these relationships, given its current socioeconomic challenges and their impact on healthcare delivery and mental health outcomes. The economic crisis has led to significant emigration of healthcare professionals, medication shortages, and deterioration of healthcare infrastructure, all of which particularly affect vulnerable populations such as the elderly (12). Understanding the relationship between neurocognitive disorders and depression in this context is crucial for developing appropriate interventions and allocating limited resources effectively.

The assessment of cognitive function and depressive symptoms in elderly populations requires culturally appropriate and validated instruments. The Mini-Mental State Examination (MMSE) remains widely used for cognitive screening despite its limitations, while the Beck Depression Inventory (BDI) provides a reliable measure of depression severity (13). Additionally, the evaluation of automatic thoughts and cognitive distortions provides insights into the cognitive patterns that may maintain or exacerbate both depressive symptoms and cognitive decline (14).

Previous research in Latin American populations has demonstrated varying prevalence rates of both depression and cognitive impairment in elderly populations, with rates influenced by methodology, setting, and population characteristics (15). Studies from Colombia, Mexico, and Brazil have reported prevalence rates of depression in elderly populations ranging from 20 % to 40 %, with higher rates observed in clinical settings and among those with chronic medical conditions (16). Similarly, the prevalence of cognitive impairment varies widely, with estimates ranging from 5 % to 30 %, depending on age group and assessment methods (17).

The implications of the depression-cognitive impairment relationship extend beyond individual patient outcomes to broader public health considerations. The economic burden of both conditions is substantial, including direct healthcare costs, informal caregiving, and lost productivity (18). Early identification and simultaneous intervention strategies targeting both conditions may improve outcomes while reducing overall healthcare costs (19).

Given this background, the present study aimed to assess the association between cognitive impairment and depression severity, and to describe how cognitive distortion patterns vary by depression severity, among patients treated at the Psychiatric Hospital of Maracaibo, Venezuela. This research addresses a critical gap in understanding these relationships within the specific context of a Venezuelan psychiatric population facing unique socioeconomic challenges.

MATERIAL AND METHODS

Study Design and Setting

This cross-sectional, correlational, and descriptive study was conducted at the Psychiatric Hospital of Maracaibo, Venezuela, between November 2023 and October 2024. The study design was non-experimental and cross-sectional, allowing for the observation of variables in

their natural context without manipulation. The Psychiatric Hospital of Maracaibo serves as the primary psychiatric referral center for the Zulia state, providing both inpatient and outpatient services to a diverse population affected by various mental health conditions.

Study Population and Sampling

The study population consisted of patients diagnosed with depressive disorders according to DSM-5-TR criteria who attended consultations at the hospital during the study period. A consecutive, non-probability sampling approach was used. Eligible patients attending consultations during the study period were invited to participate, and enrollment continued until 100 participants were included. This hospital-based sample reflects the patient flow during the defined recruitment window rather than a population census.

Inclusion and Exclusion Criteria

Inclusion criteria were: 1) patients of both sexes; 2) age between 50 and 85 years; 3) diagnosed according to DSM-5-TR criteria and under treatment for a depressive episode; 4) absence of subjective cognitive impairment complaints at the time of initial depression diagnosis.

Exclusion criteria included: 1) intellectual developmental disorder (intellectual disability); 2) diagnosis of epilepsy; 3) regular consumption of alcohol or other psychoactive substances (excluded to reduce potential confounding because substance use can affect mood symptoms and cognitive test performance); 4) illiteracy; 5) refusal to provide informed consent.

Data Collection Instruments

Four validated instruments were utilized for data collection:

1. Sociodemographic Survey: A structured questionnaire collecting information on age, sex, socioeconomic level (Graffar scale), educational level, marital status, occupation, and relevant comorbidities.
2. Beck Depression Inventory (BDI): The BDI is a 21-item self-report scale that assesses depressive symptom severity. Participants completed the instrument in Spanish. Spanish-language versions of the BDI have shown good reliability and validity in Spanish-speaking populations (20). Scores were interpreted using the conventional categories applied in this study: 0-13 (mild), 14-19 (mild-to-moderate), 20-28 (moderate), and 29-63 (severe) (20).
3. Mini-Mental State Examination (MMSE): The MMSE is a 30-point clinician-administered cognitive screening test. It was administered in Spanish by trained personnel using a Spanish-language version (21). For descriptive purposes, cognitive impairment was defined as an MMSE score <24, a commonly used threshold. Because MMSE performance varies with educational attainment, and because education was examined as a sociodemographic factor, we primarily present and interpret MMSE as a continuous measure and interpret dichotomized classifications cautiously, particularly across education strata (22).
4. Automatic Thoughts Inventory (Ruiz and Luján): The Ruiz and Luján Automatic Thoughts Inventory is a 45-item self-report instrument designed to assess patterns of automatic negative thoughts and cognitive distortions. The Spanish-language instrument was administered as originally developed (23).

Internal consistency in the present sample (e.g., Cronbach's alpha or McDonald's omega) requires item-level responses. Item-level responses for the self-report instruments were not retained in the analytic dataset; therefore, we could not estimate alpha/omega for the BDI or the Automatic Thoughts Inventory in this sample, and we acknowledge this as a limitation of the study.

Data Collection Procedure

Following institutional review board approval, potential participants and their family members received detailed explanations about the study objectives and procedures. After obtaining

written informed consent, a comprehensive clinical history was conducted, including detailed anamnesis and clinical examination focusing on neurocognitive and depressive symptoms.

Data collection was performed by trained research personnel under the supervision of the principal investigator. All assessments were conducted in a quiet, private setting within the hospital to ensure participant comfort and data quality. The instruments were administered in a standardized sequence to minimize fatigue effects, with breaks provided as needed.

Statistical Analysis

Data were analyzed using SPSS version 25.0 (IBM Corporation, Armonk, NY). Descriptive statistics included frequencies, percentages, means, and standard deviations. The normality of continuous variables was assessed using the Kolmogorov-Smirnov test.

For inferential analysis, Chi-Square tests were used to examine associations between categorical variables. Pearson correlation coefficients were calculated to assess relationships between continuous variables. One-way analysis of variance (ANOVA) was employed to compare mean scores across depression severity groups. In accordance with the journal policy, we do not report p-values; results are presented as effect estimates with 95 % confidence intervals (CIs) and interpreted based on magnitude and precision. For the 15 cognitive distortion subscales, comparisons are considered exploratory and are summarized using mean differences (and standardized effect sizes) with 95 % CIs (Supplementary Table 1).

Key associations are reported as effect estimates with 95 % confidence intervals (CIs), including prevalence ratios (PRs) derived from contingency tables. Given sparse cells in some comparisons (e.g., zero cognitive impairment in the mild depression group), we did not fit multivariable regression models because standard adjusted models would be unstable; therefore, results are presented and interpreted as bivariate associations.

Ethical Considerations

The study protocol was approved by the Ethics Committee of the Psychiatric Hospital of Maracaibo (approval reference number: 202510-25). It was conducted in accordance with the principles of the Declaration of Helsinki. All participants provided written informed consent after receiving comprehensive information about the study objectives, procedures, potential risks and benefits, and their right to withdraw at any time without affecting their clinical care.

Participant confidentiality was maintained by using coded identifiers, with personal information stored separately from research data in locked files accessible only to the research team. Participants identified with severe depression or significant cognitive impairment were referred for appropriate clinical intervention as part of their routine care.

RESULTS

Descriptive Statistics

The study included 100 patients with depressive disorders, with ages ranging from 54 to 82 years (mean 68.0 ± 7.3 years). The sample comprised equal numbers of men and women (50 each). Regarding socioeconomic status, participants were distributed across the middle-low stratum (30 %), the working class (35 %), and extreme poverty (35 %), with no participants from the upper or upper-middle socioeconomic strata. Educational attainment varied, with 42 % having completed secondary education, 33 % having completed university education, and 25 % having completed only primary education. Marital status distribution showed 55 % married, 23 % single, 17 % widowed, and 5 % divorced. Employment status revealed that 75 % were unemployed, 15 % worked in commerce, and 10 % were manual laborers (Table 1).

Based on the Beck Depression Inventory, 55/100 participants had moderate depression (55.0 %, 95 % CI 45.2-64.4), 35/100 severe depression (35.0 %, 95 % CI 26.4-44.7), and 10/100 mild depression (10.0 %, 95 % CI 5.5-

Table 1. Sociodemographic Characteristics

Characteristic	Category	Count (N=100)
Age	Range	54–82 years
	Mean (SD)	68.0 ± 7.3 years
Sex	Female	50
	Male	50
Socioeconomic Level	Graffar I	0
	Graffar II	0
	Graffar III	30
	Graffar IV	35
	Graffar V	35
Education Level	Illiterate	0
	Primary	25
	Secondary	42
	University	33
Marital Status	Single	23
	Married	55
	Divorced	5
	Widowed	17
Occupation	Unemployed	75
	Worker	10
	Merchant	15

17.4) (Table 2). Mild depression occurred only among men (10/10, 100.0 %, 95 % CI 72.2-100.0). In the moderate group, women represented 34/55 (61.8 %, 95 % CI 48.6-73.5), whereas in the severe group men represented 19/35 (54.3 %, 95 % CI 38.2-69.5). Socioeconomic status was concentrated in Graffar III–V, with all mild cases in Graffar V (10/10, 100.0 %, 95 % CI 72.2-100.0). Education also varied across severity groups: all mild cases had primary education (10/10, 100.0 %, 95 % CI 72.2-100.0), while university education accounted for 17/35 (48.6 %, 95 % CI 33.0-64.4) of severe cases. Regarding marital status, most participants with severe depression were married (25/35, 71.4 %, 95 % CI 55.2-83.7). In terms of occupation, all severe cases were unemployed (35/35, 100.0 %, 95 % CI 90.1-100.0), while the moderate group included 31/55 unemployed (56.4 %, 95 % CI 43.3-68.6), 10/55 workers (18.2 %, 95 % CI 10.2-30.4), and 14/55 merchants (25.5 %, 95 % CI 15.8-38.5) (Table 2).

Bivariate Associations

Overall, cognitive impairment (MMSE <24) was present in 63/100 participants (63.0 %, 95 % CI 53.2–71.8) (Table 3). The prevalence was 35/50 among women (70.0 %, 95 % CI 56.2–80.9)

Table 2. Beck Depression Inventory (BDI) Scores

Characteristic	Category	Mild (N=10)	Moderate (N=55)	Severe (N=35)	Total (N=100)
Sex					
	Female	0/10 (0.0 %) [0.0–27.8]	34/55 (61.8 %) [48.6–73.5]	16/35 (45.7 %) [30.5–61.8]	50/100 (50.0 %) [40.4–59.6]
	Male	10/10 (100.0 %) [72.2–100.0]	21/55 (38.2 %) [26.5–51.4]	19/35 (54.3 %) [38.2–69.5]	50/100 (50.0 %) [40.4–59.6]
Socioeconomic level					
	Graffar I	0/10 (0.0 %) [0.0–27.8]	0/55 (0.0 %) [0.0–6.5]	0/35 (0.0 %) [0.0–9.9]	0/100 (0.0 %) [0.0–3.7]
	Graffar II	0/10 (0.0 %) [0.0–27.8]	0/55 (0.0 %) [0.0–6.5]	0/35 (0.0 %) [0.0–9.9]	0/100 (0.0 %) [0.0–3.7]
	Graffar III	0/10 (0.0 %) [0.0–27.8]	16/55 (29.1 %) [18.8–42.1]	14/35 (40.0 %) [25.6–56.4]	30/100 (30.0 %) [21.9–39.6]
	Graffar IV	0/10 (0.0 %) [0.0–27.8]	20/55 (36.4 %) [24.9–49.7]	15/35 (42.9 %) [28.3–58.8]	35/100 (35.0 %) [26.3–44.8]
	Graffar V	10/10 (100.0 %) [72.2–100.0]	19/55 (34.5 %) [23.3–47.7]	6/35 (17.1 %) [8.2–32.4]	35/100 (35.0 %) [26.3–44.8]
Education level					
	Illiterate	0/10 (0.0 %) [0.0–27.8]	0/55 (0.0 %) [0.0–6.5]	0/35 (0.0 %) [0.0–9.9]	0/100 (0.0 %) [0.0–3.7]
	Primary	10/10 (100.0 %) [72.2–100.0]	9/55 (16.4 %) [8.8–28.4]	6/35 (17.1 %) [8.2–32.4]	25/100 (25.0 %) [17.4–34.4]
	Secondary	0/10 (0.0 %) [0.0–27.8]	30/55 (54.5 %) [41.5–67.0]	12/35 (34.3 %) [20.9–50.5]	42/100 (42.0 %) [32.8–51.7]
	University	0/10 (0.0 %) [0.0–27.8]	16/55 (29.1%) [18.8–42.1]	17/35 (48.6 %) [32.9–64.6]	33/100 (33.0 %) [24.5–42.8]
Marital status					
	Single	0/10 (0.0 %) [0.0–27.8]	15/55 (27.3 %) [17.3–40.2]	8/35 (22.9 %) [12.0–39.0]	23/100 (23.0 %) [15.7–32.3]
	Married	5/10 (50.0 %) [23.7–76.3]	25/55 (45.5 %) [33.0–58.5]	25/35 (71.4 %) [55.2–83.7]	55/100 (55.0 %) [45.2–64.4]
	Divorced	0/10 (0.0 %) [0.0–27.8]	5/55 (9.1 %) [3.9–19.6]	0/35 (0.0 %) [0.0–9.9]	5/100 (5.0 %) [2.1–11.2]
	Widowed	5/10 (50.0 %) [23.7–76.3]	10/55 (18.2 %) [10.2–30.4]	2/35 (5.7 %) [1.6–19.1]	17/100 (17.0 %) [10.9–25.5]
Occupation					
	Unemployed	9/10 (90.0 %) [59.6–98.2]	31/55 (56.4 %) [43.3–68.6]	35/35 (100.0 %) [90.1–100.0]	75/100 (75.0 %) [65.6–82.6]
	Worker	0/10 (0.0 %) [0.0–27.8]	10/55 (18.2 %) [10.2–30.4]	0/35 (0.0 %) [0.0–9.9]	10/100 (10.0 %) [5.5–17.5]
	Merchant	1/10 (10.0 %) [1.8–40.4]	14/55 (25.5 %) [15.8–38.5]	0/35 (0.0 %) [0.0–9.9]	15/100 (15.0 %) [9.2–23.4]

and 28/50 among men (56.0 %, 95 % CI 42.3-68.8). Participants with cognitive impairment were older (mean age 70.1 ± 7.0 years, 95 % CI 68.3-71.9) than those without impairment (63.9 ± 5.8 years, 95 % CI 62.0–65.8). By depression severity, cognitive impairment was absent in mild depression (0/10, 0.0 %, 95 % CI 0.0-27.8), present in 30/55 with moderate depression (54.5 %, 95 % CI 41.5-67.0), and present in 33/35 with severe depression (94.3 %, 95 % CI 81.4-98.4). Cognitive impairment was more frequent in severe than non-severe depression (94.3 % vs 46.2 %), with PR 2.04 (95.% CI 1.55-2.69). Mean MMSE scores decreased with increasing depression severity (mild: 25.0 ± 1.2, 95 % CI 24.1–25.9; moderate: 22.0 ± 4.1, 95 % CI 20.9–23.1; severe: 18.1 ± 3.6, 95 % CI 16.9–19.3) (Table 3).

Table 3. Mini-Mental State Examination (MMSE) Scores by Demographic Characteristics and Depression Severity

Group	No cognitive impairment (N=37)	Cognitive impairment (N=63)	Cognitive impairment prevalence, n/N (%) [95 % CI]	MMSE mean ± SD (95 % CI) for subgroup
Overall	37	63	63/100 (63.0 %) [53.2–71.8]	
Female	15	35	35/50 (70.0 %) [56.2–80.9]	21.0 ± 5.9 (19.3–22.7)
Male	22	28	28/50 (56.0 %) [42.3–68.8]	21.7 ± 4.7 (20.4–23.0)
Age (years), mean ± SD (95 % CI)	63.9 ± 5.8 (62.0–65.8)	70.1 ± 7.0 (68.3–71.9)		
Mild depression	10	0	0/10 (0.0 %) [0.0–27.8]	25.0 ± 1.2 (24.1–25.9)
Moderate depression	25	30	30/55 (54.5 %) [41.5–67.0]	22.0 ± 4.1 (20.9–23.1)
Severe depression	2	33	33/35 (94.3 %) [81.4–98.4]	18.1 ± 3.6 (16.9–19.3)

Note: MMSE mean ± SD values represent the average cognitive performance score for all participants within each row subgroup (Female, Male, or depression severity category), regardless of their dichotomous cognitive impairment classification. Cognitive impairment prevalence was defined as MMSE <24. N represents the total number of participants in each category.

Supplementary Table 1 shows mean ± SD cognitive distortion subscale scores across depression severity groups (mild, n=10; moderate, n=55; severe, n=35) and the corresponding mean differences for severe versus moderate and severe versus mild with 95 % Cis. For the 15 cognitive distortion subscales, comparisons are considered exploratory and are summarized using mean differences (and standardized effect sizes) with 95 % Cis. Overall, severe depression tended to have higher subscale scores than moderate and mild across most domains, with particularly high severe group means for fallacy of heavenly reward (6.4 ± 4.5), overgeneralization (6.0 ± 2.2), and should statements (6.0 ± 1.7). The largest severe minus mild differences were observed for overgeneralization (5.00, 95 % CI 3.80 to 6.20), fallacy of heavenly reward (4.90, 95 % CI 3.30 to 6.50), catastrophizing (4.20, 95 % CI 3.38 to 5.02), and mind reading (3.50, 95 % CI 2.54 to 4.46). The largest severe minus moderate differences were for fallacy of heavenly reward (3.10, 95 % CI 1.46 to 4.74), polarized thinking (3.00, 95 % CI 2.08 to 3.92), and overgeneralization (2.80, 95 % CI 1.88 to 3.72). Severe–moderate differences were uncertain for catastrophizing (0.80, 95 % CI -0.17 to 1.77) and personalization (-0.10, 95 % CI -1.00 to 0.80), and severe–mild differences were uncertain for personalization (0.50, 95 % CI -0.29 to 1.29) and emotional reasoning (1.30, 95 % CI -0.36 to 2.96). Collectively, the pattern was compatible with increasing cognitive distortion scores with greater depression severity, with no clear gradients for personalization and limited uncertainty for catastrophizing and emotional reasoning.

Multivariable regression models were not performed due to sparse data in several cells (e.g., zero cognitive impairment cases in the mild depression group, 100 % unemployment in the severe depression group), which would result in unstable estimates and convergence issues. Given these constraints, all associations are presented as unadjusted bivariate estimates with 95 % confidence intervals and should be interpreted cautiously regarding potential confounding by demographic and clinical factors.

Supplementary Table 1. Automatic Thoughts Inventory subscale scores by depression severity.

Subscale	Mild (n=10) mean ± SD	Moderate (n=55) mean ± SD	Severe (n=35) mean ± SD	Mean difference Severe minus Moderate (95 % CI)	Mean difference: : Severe minus Mild (95 % CI)
Filtering	2.5 ± 0.7	3.4 ± 2.3	5.8 ± 1.4	2.40 (1.62 to 3.18)	3.30 (2.64 to 3.96)
Polarized Thinking	2.0 ± 1.4	2.4 ± 1.8	5.4 ± 2.3	3.00 (2.08 to 3.92)	3.40 (2.19 to 4.61)
Overgeneralization	1.0 ± 1.4	3.2 ± 2.0	6.0 ± 2.2	2.80 (1.88 to 3.72)	5.00 (3.80 to 6.20)
Mind Reading	1.5 ± 0.7	3.7 ± 3.3	5.0 ± 2.5	1.30 (0.08 to 2.52)	3.50 (2.54 to 4.46)
Catastrophizing	1.0 ± 0.0	4.4 ± 2.0	5.2 ± 2.4	0.80 (-0.17 to 1.77)	4.20 (3.38 to 5.02)
Personalization	2.0 ± 0.0	2.6 ± 1.7	2.5 ± 2.3	-0.10 (-1.00 to 0.80)	0.50 (-0.29 to 1.29)
Fallacy of Control	3.5 ± 0.7	3.0 ± 2.5	4.7 ± 1.8	1.70 (0.80 to 2.60)	1.20 (0.44 to 1.96)
Fallacy of Justice	3.5 ± 0.7	3.0 ± 2.5	4.5 ± 1.4	1.50 (0.68 to 2.32)	1.00 (0.34 to 1.66)
Emotional Reasoning	3.5 ± 2.1	2.7 ± 2.0	4.8 ± 2.5	2.10 (1.10 to 3.10)	1.30 (-0.36 to 2.96)
Fallacy of Change	2.0 ± 1.4	2.7 ± 1.1	5.0 ± 1.1	2.30 (1.83 to 2.77)	3.00 (1.96 to 4.04)
Global Labeling	2.5 ± 0.7	2.2 ± 1.8	4.7 ± 1.3	2.50 (1.85 to 3.15)	2.20 (1.56 to 2.84)
Blaming	2.5 ± 0.3	2.1 ± 2.1	4.8 ± 1.3	2.70 (1.99 to 3.41)	2.30 (1.82 to 2.78)
Should Statements	3.5 ± 2.1	3.3 ± 1.9	6.0 ± 1.7	2.70 (1.93 to 3.47)	2.50 (0.93 to 4.07)
Fallacy of Rightness	3.0 ± 2.8	3.7 ± 2.9	5.2 ± 2.1	1.50 (0.45 to 2.55)	2.20 (0.12 to 4.28)
Fallacy of Heavenly Reward	1.5 ± 0.7	3.3 ± 2.2	6.4 ± 4.5	3.10 (1.46 to 4.74)	4.90 (3.30 to 6.50)

DISCUSSION

This study provides important insights into the relationship between neurocognitive disorders and major depressive disorder in a Venezuelan psychiatric population facing unique socioeconomic challenges. The findings demonstrate a strong association between depression severity and cognitive impairment, with 94.2 % of patients with severe depression exhibiting cognitive deterioration. Because the study is cross-sectional, the findings should be interpreted as associations and do not establish temporality or causality.

The high prevalence of cognitive impairment (63 %) in our depressed sample exceeds rates reported in some international studies. Still, it aligns with Latin American research showing elevated rates of cognitive dysfunction in elderly depressed populations (24). This elevated prevalence may reflect multiple factors, including the advanced age of our sample, the clinical setting, and potentially the impact of Venezuela's socioeconomic crisis on mental health outcomes. The mean age of 68 years in our sample represents a particularly vulnerable period for both depression and cognitive decline, consistent with literature indicating accelerated cognitive deterioration after age 65 (25).

Our findings regarding sex differences merit particular attention. Women showed higher rates of both moderate depression and cognitive impairment, consistent with global epidemiological data indicating higher depression prevalence in women (26). However, the slightly higher rate of severe depression in men contradicts some international findings and may reflect cultural factors affecting symptom expression or help-seeking behaviors in Venezuelan men.

In our sample, cognitive impairment was more frequent among women than men, aligning with research suggesting that women may be more vulnerable to depression-related cognitive decline, possibly due to hormonal factors, longer life expectancy, or differential exposure to psychosocial stressors (27).

The relationship between educational level and depression severity revealed complex patterns. While higher education generally serves as a protective factor against cognitive decline through cognitive reserve mechanisms (28), our finding that 51.5 % of university-educated participants had severe depression suggests additional factors at play. This paradoxical finding may reflect greater awareness of functional limitations among educated individuals, leading to increased depressive symptoms, or it may reflect the impact of downward social mobility during Venezuela's economic crisis, in which educated professionals may experience particular distress from the loss of occupational status and economic security (29).

Employment status emerged as a powerful correlation of depression severity, with all severely depressed patients being unemployed. This finding underscores the bidirectional relationship between depression and functional impairment, where depression may lead to job loss while unemployment exacerbates depressive symptoms (30). In the Venezuelan context, where economic opportunities are severely limited, unemployment may represent both a cause and consequence of mental health problems, creating vicious cycles that perpetuate both depression and cognitive decline.

The inverse relationship between MMSE scores and depression severity supports the concept of depression-related cognitive impairment or "pseudodementia," though current understanding recognizes this as more than a reversible epiphenomenon (31). The cognitive deficits observed in our severely depressed patients likely reflect both the acute effects of depression on attention and executive function and potentially irreversible neurobiological changes associated with chronic depression. Neuroimaging studies have documented hippocampal atrophy, white matter changes, and altered connectivity in depressed elderly patients, changes that may persist even after mood symptoms improve (32).

The analysis of cognitive distortions provides novel insights into the cognitive mechanisms linking depression and cognitive impairment. The pattern of higher cognitive distortion scores in severe depression, particularly for filtering, overgeneralization, and catastrophizing, suggests that maladaptive thinking patterns may mediate the relationship between mood and cognition. These cognitive distortions may create negative feedback loops, where distorted thinking exacerbates depression, which in turn impairs cognitive function, leading to further distorted perceptions and interpretations (33).

The prominence of "should statements" and "heaven's reward fallacy" in severely depressed patients may reflect cultural and religious influences on cognitive patterns in this Latin American population. These findings suggest that culturally adapted cognitive-behavioral interventions targeting specific distortion patterns might be particularly beneficial (34). The lack of association between depression severity and certain distortions (personalization, control fallacy) indicates that not all cognitive distortions contribute equally to the depression-cognition relationship, highlighting the importance of targeted assessment and intervention approaches.

Our results have important implications for clinical practice in resource-limited settings. The strong association between depression and cognitive impairment argues for routine cognitive screening in depressed elderly patients and mood assessment in those presenting with cognitive complaints. The feasibility of using brief screening instruments like the MMSE and BDI in busy clinical settings makes such integrated assessment practical even in resource-constrained environments (35).

The findings also highlight the need for integrated treatment approaches addressing both mood and cognitive symptoms. While antidepressant medications may improve both depressive symptoms and some aspects of cognitive function, comprehensive interventions including psychotherapy, cognitive training, and social support are likely needed for optimal outcomes (36). The identification of specific cognitive distortion patterns associated with severe depression suggests that cognitive-behavioral therapy techniques targeting these distortions might be particularly beneficial.

From a public health perspective, our findings underscore the urgency of developing mental health programs for elderly populations in Venezuela and similar settings. The high prevalence of both depression and cognitive impairment, combined with high unemployment and poverty rates in our sample, indicates substantial unmet mental health needs. Early intervention programs targeting mild depression might prevent progression to severe depression and associated cognitive impairment, potentially reducing the individual and societal burden of these conditions (37). This is consistent with evidence from Peru, where socioeconomic factors like income reduction contributed to post-traumatic stress in vulnerable groups, emphasizing the need for resource-conscious mental health strategies in Latin America (38,39).

The study's strengths include its focus on an understudied population facing unique challenges, the use of multiple validated assessment instruments, and the comprehensive evaluation of cognitive distortions alongside standard measures of depression and cognition. The equal sex distribution allows for robust sex-based comparisons, while the range of socioeconomic and educational backgrounds enhances generalizability to similar populations.

However, several limitations must be acknowledged. The cross-sectional design precludes causal inferences. The hospital-based sample reflects patients attending a psychiatric referral center and may not represent community-dwelling older adults, potentially inflating prevalence estimates. Additionally, the absence of multivariable regression models, due to sparse cells and zero counts in key cross-tabulations, limits our ability to assess whether the observed associations between depression severity and cognitive impairment remain significant after adjustment for potential confounders such as age, sex, education, or socioeconomic status. All reported associations are therefore unadjusted bivariate estimates and should be interpreted with causality and confounding. We did not maintain a screening log of approached and eligible patients; therefore, we cannot quantify the proportion eligible/included, and selection bias is possible. The exclusion of individuals with regular alcohol or psychoactive substance use improves internal validity for cognitive testing but may limit generalizability to clinical populations where comorbid substance use is common. The exclusion of illiterate individuals further limits generalizability to the most educationally disadvantaged groups.

The use of the MMSE, while practical, has known limitations including ceiling effects, cultural bias, and limited sensitivity to executive dysfunction (40). Future studies might benefit from more comprehensive neuropsychological batteries that better characterize the specific cognitive domains affected. Similarly, although the BDI is well validated, cultural factors may influence symptom expression and reporting in ways not fully captured by this instrument. In addition, item-level responses for the self-report instruments were not retained, which precluded estimation of internal consistency (Cronbach's alpha/McDonald's omega) in this sample.

The study did not assess potentially important variables such as medical comorbidities, medication use, social support, or lifetime history of depression, all of which might influence the depression-cognition relationship. The impact of Venezuela's specific socioeconomic crisis on mental health outcomes also deserves more detailed investigation, including factors such as medication availability, access to healthcare, and stress related to political instability.

Future research should employ longitudinal designs to clarify temporal relationships and identify predictors of progression from depression to cognitive impairment or vice versa. Studies comparing hospital and community samples would help establish true population prevalence rates. Investigation of biological markers, including inflammatory cytokines, cortisol levels, and neuroimaging parameters, could elucidate mechanisms linking depression and cognitive decline in this population (41).

Research on the effectiveness of interventions in this population is urgently needed. Studies comparing different treatment modalities (pharmacological, psychological, combined) and their impact on both mood and cognitive outcomes would inform clinical practice. The development and validation of culturally adapted assessment instruments and interventions specifically designed for Latin American elderly populations represents another important research priority.

The role of modifiable risk factors deserves particular attention. Research investigating the impact of social engagement, physical activity, nutritional status, and management of vascular risk factors on the depression-cognition relationship could identify targets for preventive interventions. Given resource constraints in settings such as Venezuela, research on cost-effective, scalable interventions, potentially including task-shifting approaches employing trained non-specialists, would be particularly valuable.

CONCLUSION

This study demonstrates a strong association between major depressive disorder and cognitive impairment in elderly Venezuelan psychiatric patients, with 94.2 % of severely depressed individuals showing cognitive deterioration. These results should be interpreted as cross-sectional associations. Longitudinal studies are needed to clarify temporal relationships between depression severity, cognitive impairment, and cognitive distortion patterns. Sex, education, and employment status significantly influence both depression severity and cognitive outcomes, highlighting the complex interplay between sociodemographic factors and mental health in this population.

These findings emphasize the critical need for integrated mental health services that address both mood and cognitive symptoms in elderly populations. Routine screening for both conditions, combined with comprehensive interventions targeting identified cognitive distortions and socioeconomic stressors, may improve outcomes in this vulnerable population. The results underscore the importance of early detection and intervention, particularly given the limited resources available in the current Venezuelan healthcare context.

The study contributes to understanding the depression-cognition relationship in Latin American populations facing socioeconomic challenges and provides a foundation for developing culturally appropriate, resource-conscious interventions. As populations age globally and mental health needs increase, particularly in resource-limited settings, research identifying effective, scalable approaches to addressing comorbid depression and cognitive impairment becomes increasingly critical for public health planning and clinical practice.

Author Contributions (CRediT)

Tatiana María Berrocal Hoyos: Conceptualization, Writing – original draft. Dexy Prieto de Rincón: Conceptualization, Writing – original draft. Claudia Milena Garizábalo Dávila: Writing – original draft. Fabriccio J. Visconti-Lopez: Methodology, Validation, Writing – original draft. All authors had full access to the data in the study and took responsibility for the integrity of the data and the accuracy of the data analysis.

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