NAME _____ AGE_____ SEX_____ DATE _____

Cornell Scale for Depression in Dementia

Ratings should be based on symptoms and signs occurring during the week before interview. No score should be given if symptoms result from physical disability or illness.

SCORING SYSTEM

a = Unable to evaluate 0 = Absent
1 = Mild to Intermittent 2 = Severe

Score greater than 12 = Probable Depression

	a	0	1	2
A. MOOD-RELATED SIGNS				
1. Anxiety; anxious expression, rumination, worrying				
2. Sadness; sad expression, sad voice, tearfulness				
3. Lack of reaction to pleasant events				
4. Irritability; annoyed, short tempered				
B. BEHAVIORAL DISTURBANCE	a	0	1	2
5. Agitation; restlessness, hand wringing, hair pulling				
6. Retardation; slow movements, slow speech, slow reactions				
7. Multiple physical complaints *(score 0 if gastrointestinal symptoms only)*				
8. Loss of interest; less involved in usual activities *(score 0 only if change occurred acutely, i.e., in less than one month)*				
C. PHYSICAL SIGNS	a	0	1	2
9. Appetite loss; eating less than usual				
10. Weight loss *(score 2 if greater than 5 pounds in one month)*				
11. Lack of energy; fatigues easily, unable to sustain activities				
D. CYCLIC FUNCTIONS	a	0	1	2
12. Diurnal variation of mood; symptoms worse in the morning				
13. Difficulty falling asleep; later than usual for this individual				
14. Multiple awakenings during sleep				
15. Early morning awakening; earlier than usual for this individual				
E. IDEATIONAL DISTURBANCE	a	0	1	2
16. Suicidal; feels life is not worth living				
17. Poor self-esteem; self-blame, self-depreciation, feelings of failure				
18. Pessimism; anticipation of the worst				
19. Mood congruent delusions; delusions of poverty, illness or loss				

NOTES/CURRENT MEDICATIONS:

ASSESSOR:

Score

Instruction for use: (Cornell Dementia Depression Assessment Tool)

1. The same CNA (certified nursing assistant) should conduct the interviewed each time to assure consistency in the response.
2. The assessment should be based on the patient's normal weekly routine.
3. If uncertain of answers, questioning other caregivers may further define the answer.
4. Answer all questions by placing a check in the column under the appropriately numbered answer. (a=unable to evaluate, 0=absent, 1=mild to intermittent, 2=severe).
5. Add the total score for all numbers checked for each question.
6. Place the total score in the "SCORE" box and record any subjective observation notes in the "Notes/Current Medications" section.
7. Scores totaling twelve (12) points or more indicate probable depression.

Factor Structure of the Cornell Scale for Depression in Dementia for Anglo and Hispanic Patients With Dementia

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The authors assessed the equivalence of the factor structure of the Cornell Scale for Depression in Dementia (CSDD) in samples of Anglo and Hispanic patients with Alzheimer's disease (AD). Comparing the factor structure of the CSDD in these groups helps establish its validity and aids in its clinical interpretation with Hispanic patients. CSDD ratings were first subjected to preliminary exploratory factor analyses; then the factor structure of the CSDD across groups of English- and Spanish- speaking patients was tested using structural equation modeling. Analyses showed overall similarity in the CSDD factor structure for the two groups but also revealed differences in factor content for several items. The authors discuss the relevance of these differences for those using the CSDD with Hispanic AD patients. (Am J Geriatr Psychiatry 2001; 9:217–224)

Depression is a common problem among patients with Alzheimer's disease (AD). Symptoms of depression in patients with AD may include mood, cognitive, somatic, and behavioral symptoms, such as sadness, sleep disturbance, and psychomotor agitation or retardation.[1] Estimates of the prevalence of depression in AD vary widely depending on sample and diagnostic criteria, ranging from 10% to 20%.[2,3] Although specific estimates vary, there is a clear consensus that depression is a critically important problem for patients with AD and that clinicians should address it in their work.

Although a significant body of research has addressed mood disturbance among patients with AD, few investigators have studied patterns of depressive symptoms across different language or cultural groups. Emotional distress may be experienced differently in diverse cultures. Hispanics, for instance, have been shown to report greater somatic complaints, compared with Anglos.[4,5] This suggests that patterns of depressive symptoms may vary according to language and cultural backgrounds.[6] Although symptoms of negative mood are more common among Hispanic than Anglo AD patients,[7,8] these studies did not assess whether the pattern, rather than level, of depressive symptoms is different among patients with AD who come from diverse language and cultural backgrounds. If depression is

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similar across language and cultural groups, then similar patterns of covariation among mood symptoms should exist across the same groups.

Problems in measuring depression in patients with AD include patients' difficulties in accurately remembering and reporting their mood status. As with other older adults without AD, patients with AD may be inclined to underreport their depressive symptoms.[9–12] Self-rating instruments may also be inaccurate.[13,14] Several studies have suggested that a more appropriate way to assess depression in patients with AD may be via collateral interviews with patients' caregivers.[9,10,12] Of the instruments that exist for assessment of patient psychopathology via collateral interview, the Cornell Scale for Depression in Dementia (CSDD)[15] is the most comprehensive measure of depressive symptoms as they appear in patients with dementia.

The CSDD is a 19-item scale that utilizes information from an interview with the patient and caregiver. Item selection was based on a literature review and expert recommendations about depression in patients with dementing illnesses.[15] The CSDD is more reliable than several other commonly used scales, such as the Hamilton Depression Rating Scale (Ham-D) and the Dementia Mood Assessment Scale.[16,17] CSDD ratings are significantly related to clinical diagnoses of depression in elderly persons with or without dementia.[15,18,19]

Symptoms of depression on the CSDD are grouped into five areas: mood (e.g., anxiety, sadness, lack of reactivity to pleasant events, irritability); behavioral disturbances (agitation, psychomotor retardation, physical complaints, loss of interest); physical symptoms (appetite loss, weight loss, lack of energy); cyclic functioning (diurnal mood variation, difficulty falling asleep, multiple awakening during sleep, early morning awakening); and ideational aspects of depression (suicidal thoughts, low self-esteem, pessimism, mood-congruent delusions). Although the items of the CSDD are classified into these categories, the basis for these groupings is not reported.[15]

Because the CSDD's authors suggest the use of clinically relevant groupings of symptoms on the scale, Harwood et al.[20] investigated these groupings via factor analysis. They showed that CSDD items could be grouped into four areas, including general depression (e.g., sadness, loss of interest, pessimism); rhythm disturbances (e.g., difficulty falling asleep, early-morning awakening); agitation/psychosis (agitation, mood-congruent delusions, suicidal ideation); and negative symptoms (appetite loss, lack of energy, and lack of reactivity). The sample used in this analysis included 137 individuals with probable or possible AD, of whom 69 (about 50%) were Spanish-speaking (primarily Cuban). Harwood et al. tested for between-group differences in CSDD ratings for English- and Spanish-speaking patients and found none. Although necessarily combined to provide a sample sufficiently large for the factor analysis, the size of the groups yielded a low power to detect between-group differences (approximately 0.54, based on a moderate effect size of 0.30 and an alpha of 0.05). Since this initial report,[20] we have administered the CSDD to a larger number of patients, allowing a more definitive test of CSDD differences between Anglo and Hispanic patients with dementia. Furthermore, the larger sample allowed exploration of the factor structures of the CSDD in these groups. The earlier study thus did not find differences between language groups in level or pattern of depressive symptoms but had low power to detect differences should they exist. Our primary purpose in this follow-up study was to continue to explore the possibility of between-group differences in the level and pattern of depressive symptoms in English- and Spanish-speaking patients with AD. Because the primary purpose of this study was exploration, we did not specify a priori hypotheses before data analyses.

METHODS

Three hundred sixteen patients evaluated at a university-affiliated outpatient memory-disorders clinic were participants in this study. After multidisciplinary assessment that included psychiatric, neurological, neuropsychological, social work, and nursing evaluations, diagnoses of possible or probable AD were made at a consensus conference. All patients met NINCDS/ADRDA diagnostic criteria for AD.[21] Assessment of patient depression with the CSDD was completed during a more extensive psychiatric evaluation by bilingual psychiatrists specializing in geriatric psychiatry. Informants were primary family caregivers who accompanied patients to the evaluation. Patient evaluation also included administration of the Mini-Mental State Exam (MMSE)[22] and Blessed Dementia Rating Scale (BDRS)[23] by bilingual social workers. Because MMSE scores are known to be affected by age and education,[24] raw MMSE scores were adjusted for these variables by use of the method

developed by Mungas et al. (MMSAdj).[25] Demographic information was assessed by self-report questionnaire and confirmed with caregivers during the social service interview.

Preliminary analyses showed that the two groups were significantly different on a number of demographic and rating-scale variables, suggesting that any differences observed between the two groups on CSDD items might be due to these group differences; that is, higher ratings of depression on the CSDD might be due to the Hispanic group's being older or having greater cognitive impairment. Analysis of covariance was then used to test whether cultural group differences on the total CSDD score remained after correction for age, age at onset of AD symptoms as reported by caregiver, cognitive function as assessed by the MMSE, and functional status as assessed by the BDRS. Although our previous study had not found between-group differences on these variables, it is possible that the previous failure to find differences was due to the small sample size and associated low power to detect differences between language groups. In order to assess whether these tests of group differences had adequate power, powers were calculated for each between-group test. These analyses showed adequate power for univariate tests of between-group differences, ranging from 0.88 to 0.99.

Ratings from the CSDD were subjected to separate exploratory factor analyses for each group. Each group was analyzed first through a principal-components analysis to determine the number of components to retain for rotation in subsequent principal-factors analyses. Criteria for retaining factors for rotation were an eigenvalue >1, supplemented by the scree test.[26] All of these analyses were done with the SPSS software package (SPSS Inc., Chicago).

Factors thus obtained were compared in several ways, as recommended by Rummel.[27] Rummel argues that comparison of the pattern of loadings between factors is best accomplished by calculating the product-moment correlation of the factor loadings for each pair of factors. He further suggests that assessment of the magnitude of the pattern of factor loadings can be accomplished by using several coefficients that reflect the relationship of factor solutions. These include the *root mean square coefficient* (pp 341–347),[28] and the *coefficient of congruence* (p 461).[28] Each of these measures was calculated for factor solutions.

Structural-equation modeling techniques allow the simultaneous estimation of a measure's factor structure in two samples and provide an overall assessment of the factor model's fit to underlying data.[29] The factor model developed from exploratory analyses of the data from Anglo patients was used to simultaneously estimate factor models in both Anglo and Hispanic patients, testing the hypothesis that the CSDD factor structure was the same in both groups. In creating the models, each CSDD item was constrained to load on the factor on which it had the highest loading. This same method was used to develop separate factor models for each group, as described below.

Several goodness-of-fit measures are calculated by the structural-equation modeling software used for simultaneous analysis of factor structures and subsequent evaluation of factor models for each group by confirmatory factor analysis (AMOS).[29] These measures included 1) the chi-square goodness-of-fit test; large values indicate significantly poor fit. This chi-square statistic is sensitive to sample size, so that even very small differences are significant; the chi-square value is used here only to compare models;[30] 2) the ratio of the chi-square value to its associated degrees of freedom; this measure allows an assessment of fit corrected for improvement in fit due to increasing model complexity; a desirable value is less than 2.50 (p 555);[29] 3) the Goodness-of-Fit Index (GFI) and Adjusted Goodness-of-Fit Index (AGFI);[31] these indexes were developed to provide an assessment of how well estimated models fit data; the AGFI is similar to the GFI but is adjusted for the complexity of the model being evaluated; values of 0.80 or greater are interpreted as indicating adequate model fit;[32] 4) Aikake's Information Criterion;[33] the AIC is an information-theoretic measure that provides a composite index of model fit and complexity; it can be compared with a value for a saturated model to assess goodness-of-fit. (A saturated model would allow all model parameters to covary with all others.) Values for the saturated models are listed in the footnotes to Table 4.

RESULTS

Descriptive statistics and results of between-group *t*-tests for demographic variables and cognitive and functional status measures are presented in Table 1. Groups differed on several of these variables, including educational history, reported age at onset of the AD symptoms, age at assessment, MMSE, adjusted MMSE, BDRS,

and total CSDD score. The relation between language group and gender approached significance. Because of these between-groups differences, analysis of covariance (ANCOVA) was used to investigate whether differences existed between the two groups on the total CSDD score after correction for these baseline differences. This analysis found significant between-group differences in total CSDD score after correction ($F_{[1, 315]} = 3.85$; $P = 0.05$). These results thus supported the hypothesis that significant differences between groups might exist in the factor structure of the scale, and comparison of factor structures for the two groups was justified.

Results of separate exploratory factor analyses are presented in Table 2. Inspection shows that the factor structures are, in general, similar, although the order of

TABLE 1. Tests of group differences on demographic variables and rating scales

Variable	Group	Mean	SD	*t*	df[a]	*P*
Years of education	Hispanics	9.46	4.96			
	Anglos	12.25	3.37	−5.94	312	<0.001
Reported age at onset, years	Hispanics	71.65	7.05			
	Anglos	76.58	6.50	−6.35	310	<0.001
Age, years	Hispanics	76.02	6.85			
	Anglos	79.86	6.21	−5.18	314	<0.001
MMSE	Hispanics	16.10	6.41			
	Anglos	19.51	5.75	−4.91	309	<0.001
MMSAdj	Hispanics	18.12	6.28			
	Anglos	20.63	5.57	−3.62	307	<0.001
BDRS	Hispanics	6.17	4.49			
	Anglos	4.61	3.47	3.30	285	0.001
Total CSDD Score	Hispanics	7.19	6.63			
	Anglos	4.98	5.50	3.22	314	0.001
Assessment of the relation of gender to group via chi-square						
				χ^2	df	*P*
	Hispanic	Men	34			
	Hispanic	Women	95			
	Anglo	Men	67			
	Anglo	Women	120	3.15	1	0.086

Note: MMSE = Mini-Mental State Exam; MMSAdj = MMSE raw score adjusted for age and education;[25] BDRS = Blessed Dementia Rating Scale.
[a]Degrees of freedom (df) for *t*-tests vary because of missing data for a few patients; all patients included in the analyses contributed Cornell Scale for Depression in Dementia (CSDD) scale ratings.

TABLE 2. Exploratory factor analyses for Hispanic and Anglo patients

	Hispanic				Anglo			
CSDD Item	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
1. Anxiety	.38	.15	.18	.11	.43	.02	.26	.21
2. Sadness	.63	.19	.30	.10	.65	.12	.16	−.03
3.Mood Reactivity	.74	.21	.28	.18	.60	.19	.21	.20
4. Irritability	.32	.25	.19	.34	.46	-.01	.15	.33
5. Agitation	.19	.34	.05	.56	.03	.03	.08	.78
6. Retardation	.41	.27	.09	.20	.57	.12	.24	.19
7. Physical Complaints	.19	.21	.21	−.03	.50	.10	.21	.20
8. Lack of Interest	.62	.16	.27	.12	.68	.18	.21	−.01
9. Appetite	.22	.17	.82	.12	.25	.71	.07	.12
10. Weight	.16	.21	.78	.11	.11	.92	.18	−.05
11. Energy	.52	.15	.44	.22	.61	.30	.26	.10
12. A.M. Worsening	.34	.34	.08	.18	.19	.26	.26	.04
13. Falling Asleep	.13	.73	.12	.12	.09	.16	.48	.08
14. Awakenings	.09	.72	.16	.13	.15	.07	.66	.09
15. Morning Awakening	.25	.68	.20	.00	.20	.02	.61	.05
16. Suicidal Ideation	.19	−.06	.09	.62	.41	.12	−.04	.36
17. Self-Esteem	.68	.03	−.03	.06	.69	.04	.02	.11
18. Pessimism	.71	.15	.06	.24	.67	.15	.08	.08
19. Delusions	.11	.11	.06	.87	.21	.02	.13	.54

extraction of Factors 2 and 3 were reversed. This similarity is confirmed by measures of factor congruency, as presented in Table 3. Overall, then, results suggest that the factor structures of the CSDD are at least moderately similar for the two groups.

Results of the structural-equation model assessment of the equality of factor structures showed that the Anglo model fit the two groups moderately well (see Table 4). Inspection of the fit indices for the combined group analysis suggested, however, that the model could be improved. Analysis of the model's fit for data only from Anglo patients showed that it fit the data well, with a chi-square-to-degrees of freedom (df) ratio of 2.00 and GFI of 0.87, and an AIC of 380.00, equivalent to that of a completely saturated model. Evaluation of the same model's fit for data from Hispanic patients showed that the fit was much worse, with a larger chi-square value, a larger chi-square-to-df ratio, lower GFI and AGFI, and a larger AIC.

A model for Hispanic patients was thus developed from the exploratory analysis presented in Table 2. The model differed from that for the Anglo patients in the following ways: 1) the item "Irritability" was allowed to load on both Factor 1 and Factor 4; 2) the item "Worse Mood in the Morning" was constrained to load on Factor 3; and 3) the item "Suicidal Ideation" loaded on Factor 4, rather than on Factor 1. Indices of fit for this model are also listed in Table 4. It can be seen that this model fits the data nearly as well as did the model for Anglo patients. The chi-square value is smaller; the chi-square/df ratio approaches 2.00; the GFI is larger than 0.80; and the AIC is less, although still not as low as that for the model for Anglo patients.

In summary, these results confirm previous results that have shown that four dimensions characterize depression as it is assessed by the CSDD (Table 5). Factor 1 in the confirmatory analyses includes items that reflect the psychic manifestations of depression, such as sadness, lack of interest, pessimism, and low self-esteem. Factor 2 in the confirmatory analyses is most clearly characterized by CSDD items that assess loss of appetite and weight, although for Hispanics it includes the item related to physical complaints. Factor 3 is composed primarily of items that reflect disturbances of sleep, but also includes the item assessing mood that is worse in the morning. Factor 4 comprises items that

TABLE 3. Indexes of factor congruency

Index	Factor Pairs[a]			
	1 – 1	2 – 3	3 – 2	4 – 4
Pearson r[b]	0.84	0.84	0.86	0.77
Congruence coefficient[c]	0.96	0.91	0.94	0.86
Root mean square coefficient[d]	0.13	0.13	0.10	0.16

[a]Factors 2 and 3 were reversed in order during extraction for the separate analyses for Anglo and Hispanic patients and are thus compared in the corresponding order.

[b]Pearson product-moment correlation whose values range from –1.00 to 1.00; all P values <0.001.

[c]Congruence coefficient (p 347);[28] values range from 0.00 to 1.00, with values near 1.00 indicating greater degrees of similarity.

[d]Root mean square coefficient (p 344),[28] an index of the root mean-squared differences between corresponding factor loadings, with values near 0.00 indicating greater degrees of similarity.

TABLE 4. Fit indexes for structural-equation model assessment of factor structure

Model	χ^{2}[a]	df	χ^2/df[b]	GFI[c]	AGFI[d]	AIC[e]
Combined group	649.20	292	2.22	0.83	0.78	825.20
Anglo with Anglo model	292.00	146	2.00	0.87	0.83	380.00
Hispanics with Anglo model	370.43	146	2.54	0.78	0.72	458.43
Hispanics with Hispanic model	315.09	145	2.17	0.81	0.75	405.09

[a]Chi-square goodness-of-fit test. Large values indicate significantly poor fit and are used here only to compare models.[30]

[b]Ratio of chi-square value to its associated degrees of freedom (df), correcting for improvement in fit due to increasing model complexity. A desirable value is less than 2.50.[29]

[c]Goodness-of-fit index. A desirable value for this index is greater than 0.80.[31]

[d]Adjusted goodness-of-fit index. This index corresponds to the GFI but is adjusted for the complexity of the model.[31]

[e]Aikake's Information Criterion;[33] the AIC is an information-theoretic measure that can be compared with a value for a saturated model to assess goodness of fit. (A saturated model would allow all model parameters to covary with all others.) The value for the saturated model for the combined analysis is 760.00, whereas that for any single group analysis is 380.00.

reflect psychosis, including delusions and agitation. For the Hispanic group, this factor includes suicidal ideation and irritability, whereas for the Anglo group, these items are related to Factor 1, the psychic manifestations of depression. These results show that although the same four dimensions are found in both Anglo and Hispanic groups, the specific items that comprise these dimensions may be different in the two groups.

DISCUSSION

This study evaluated whether the levels and patterns of depression varied in groups of patients with AD drawn from different language and cultural groups. Consistent with earlier research, we found higher levels of depression in Spanish- vs. English-speaking patients with AD.[7,8] Although the Spanish-speaking patients were older, less well educated, and more cognitively and functionally impaired than their English-speaking counterparts, their CSDD scores still remained significantly higher after controlling for these potentially confounding factors.

The demographic and clinical differences observed between the two groups merit comment. The lower level of formal education noted in the Hispanic group has been found in other groups of Hispanic AD patients[8] and may reflect group differences in educational experiences. The lower age at presentation and age at onset of the Spanish-speakers could be due to group differences in the expression of the disease. A more likely explanation, however, is that the differences result from the nature of the Anglo sample. The age of the white non-Hispanic cohort may be higher than other Anglo samples, as it was drawn from a group of persons who retired in South Florida several decades ago. Consistent with other clinic-based research with Hispanic AD patients,[8] we found that Spanish-speaking patients at our center had more severe cognitive impairment, even after accounting for age and education. From a social service perspective, this finding highlights the need for more effective outreach strategies in order to facilitate the early diagnosis and treatment of AD among community-dwelling Hispanic elders. This is particularly important in light of the recent development of treatments that may improve the cognitive, functional, and psychiatric symptoms of AD.[34,35]

Results of the confirmatory factor analyses show that the factor structure for the CSDD was, in general, similar in the two groups. Differences that may be clinically important for users of the CSDD, however, emerged in several instances. The CSDD item that assesses irritability was related both to the psychic manifestations of depression as well as psychosis in Hispanics, whereas it was only related to psychic manifestations of depression in Anglos.

The item "Physical Complaints" showed little rela-

TABLE 5. Confirmatory factor models for Hispanic and Anglo patients

	Hispanic				Anglo			
CSDD Item	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
1. Anxiety	.40				.50			
2. Sadness	.73				.65			
3. Mood Reactivity	.88				.70			
4. Irritability	.36			.28	.52			
5. Agitation				.62				.53
6. Retardation	.54				.65			
7. Physical Complaints		.29			.59			
8. Lack of Interest	.74				.73			
9. Appetite		.90				.91		
10. Weight		.83				.76		
11. Energy	.72				.73			
12. A.M. Worsening			.49				.38	
13. Falling Asleep			.74				.47	
14. Awakenings			.72				.76	
15. Morning Awakening			.75				.62	
16. Suicidal Ideation				.64	.46			
17. Self-Esteem	.54				.64			
18. Pessimism	.65				.67			
19. Delusions				.88				.85

Note: CSDD = Cornell Scale for Depression in Dementia.

tion to any dimension of depression among Spanish-speaking patients, although it was closely related to the psychic symptoms of depression among English-speaking patients. This suggests that previous findings of increased levels of physical complaints in depressed Hispanic patients[4,5] may not be so much an indication of depression as a more general characteristic of this group. Although these results should be replicated, clinicians should thus be cautious in assuming that the presence of physical complaints among Spanish-speaking patients is a symptom of depression.

Finally, the item "Suicide" was related to psychosis among Hispanics, whereas it was more closely related to the psychic symptoms of depression among Anglo patients. The clinical implication of this finding is that suicidal ideation may reflect psychosis, rather than the hopelessness in depression that it usually implies in depressed patients.

It is also noteworthy that the item tapping worse mood in the morning was closely related to sleep disturbances, especially early-morning awakening. This finding, consistent across groups, lends empirical support to the "B criterion" for the melancholic subtype of major depressive disorder as specified in DSM-IV.[36] This criterion includes the symptoms "distinct quality of depressed mood," depression worse in the morning, early-morning awakening, marked psychomotor retardation or agitation, anorexia or weight loss, and guilt as part of criteria for the presence of the melancholic subtype of depression. Conversely, agitation and retardation were not related to this cluster of symptoms in either group. Further research on the presence and pattern of melancholic symptoms in patients with dementia is clearly warranted. A clinical implication of this finding is its potential confirmation of an independent syndrome of melancholic depression in patients with AD.

Several limitations of this study should be acknowledged. First, although our sample of Hispanic patients is similar in some respects to Hispanic groups from other parts of the United States, it comprises primarily persons who came to the United States from Cuba. Substantial cultural differences exist among Hispanic groups who have come to the United States from other Central and South American countries. Caution should be exercised in generalizing these results to other Hispanic groups. Second, even though our sample is larger than that originally reported by Harwood et al.,[20] it still may not have been sufficiently large to detect all, especially small, group differences in pattern of depressive symptoms. These results should thus be interpreted as showing that depression may present in different ways in Hispanic patients, but not as showing that all likely differences have been demonstrated. Finally, it should be noted that the demonstration that one particular factor model fits data fairly well does not mean that other models might not fit the data equally well or better. Because our models drew heavily on exploratory factor analyses, it is likely that they approach the actual underlying patterns in the data, but caution should be exercised in interpreting the confirmatory factor models. Cross-validation of the models with an independent sample would be useful.

Overall, then, results of these analyses show that the same general factor structure exists for the CSDD among Anglo and Hispanic patients with AD. These analyses thus support the validity of the CSDD with Hispanic patients, as long as certain differences in item interpretation are taken into account during assessment and CSDD interpretation. Results of these analyses demonstrate the presence of clinically relevant differences in the relationships of several CSDD items to the underlying dimensions of depression that the scale assesses. These differences have clinical implications for the interpretation of specific depressive symptoms in the Hispanic and Anglo patients. Specifically, clinicians should interpret CSDD ratings of irritability, physical complaints, and suicidal ideation in the context of these findings. These items may reflect different dimensions of depression in Anglo and Hispanic patient groups. Our results also provide preliminary support for the presence in patients with AD of an independent subset of depressive symptoms that reflect melancholia. Future research will focus on further examination of these issues.

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A Psychometric Evaluation of the Cornell Scale for Depression in Dementia in a Frail, Nursing Home Population

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Objective: *The authors conducted a psychometric evaluation of the Cornell Scale for Depression in Dementia (CSDD) through factor analysis and assessment of criterion validity in an older, frail nursing home population, with a secondary analysis of pre-intervention data from a longitudinal clinical trial aimed at reducing restraints in nursing homes.* **Methods:** *The sample for the present study was 642 nursing home residents (mean [SD] age 84.3 [7.6] years; range: 61–105; 82% women) with completed CSDD scores, who were interviewed immediately before the intervention. Nursing home residents' scores from the 19-item CSDD were subjected to exploratory factor analysis and criterion-validity analysis.* **Results:** *The factor analysis resulted in four distinct clinically interpretable domains: Depression, Somatic/Vegetative, Disturbed Sleep, and Anxiety. Sixteen items were retained in these domains, and summated score indices and a global score were constructed. The global score and the four indices demonstrated adequate internal consistency and reliability. The indices generated by the factor analysis correlated as expected with criterion variables.* **Conclusion:** *Results suggest that in frail, institutionalized older adults with high rates of dementia, medical illness, and functional disability, depression measurement methods that are less dependent on items highly sensitive to comorbid conditions and not necessarily associated with depression may be more appropriate. Authors recommend further validity testing of the CSDD with similar populations of frail, institutionalized older adults.* (Am J Geriatr Psychiatry 2002; 10:600–608)

Depression is a common problem in older nursing home residents. The prevalence rates of major depressive disorder (MDD) range from 6% to 24%, and another 30% to 50% have clinically significant depressive symptoms.[1–3] Research also confirms that in this population, depressive symptoms, even in the absence of major depression, are associated with substantial morbidity and mortality.[2–4] Compared with the experience of community-dwelling older adults, depression in nursing home residents more frequently co-exists with dementia, medical illness, and functional disability. Furthermore, the somatic and vegetative symptoms pathognomic to depression may be difficult to distinguish from the somatic and vegetative symptoms alternatively

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attributable to dementia, medical illness, or functional disability, and, consequently, these somatic and vegetative symptoms may confound accurate measurement of depression in this population. Considering that depression is a treatable problem that can have a significant impact on residents' quality of life, the identification of sensitive and specific measures capable of identifying depression in this population is an important area of study. Yet, few depression rating scales have been validated among nursing home residents. Also, questions remain regarding the etiological status of somatic and vegetative symptoms in defining depression in frail, institutionalized older adults.

In this study, we conducted an exploratory factor analysis of the Cornell Scale for Depression in Dementia (CSDD) in order to determine the underlying dimensionality of the test in a frail, nursing home population. Indices also were constructed on the basis of results of the factor analysis, and the indices were subjected to an assessment of their criterion validity by estimating the magnitude of their association cross-sectionally with patient-related variables.

The Cornell Scale for Depression in Dementia (CSDD)

The Cornell Scale for Depression in Dementia (CSDD) is a 19-item, clinician-administered depression scale that was developed specifically to measure depressive symptom severity in older adults with and without dementia, and it is the only depression rating scale that has been validated in both populations.[5,6] Use of the CSDD relies on eliciting information from interviews with caregivers, as well as direct observations and interviews with patients. This instrument is administered in two steps, preferably by the same clinician. The clinician interviews the patient's caregiver on each of the items of the scale and then briefly interviews the patient. If there is a discrepancy between the clinician's observations and caregiver's report, the clinician interviews the caregiver again and attempts to clarify reasons for the discrepancy. The test is then scored on the basis of the clinician's final judgment.

Items and scoring. The CSDD construction was based on a review of recent and classical literature examining the phenomenology of depression in older adults with and without dementia and through information obtained from a questionnaire answered by 11 geriatric psychiatrists and other experts in the field.[5] The CSDD has a psychobiological orientation, with a broad spectrum of depressive symptoms in the affective, cognitive, somatic, and behavioral realms. Somatic items comprise 37% (7/19 items) of the test. Furthermore, the item content of the CSDD can be compared with the Hamilton Rating Scale for Depression (Ham-D),[7] a similar examiner-rated scale, but it relies less on verbal reports by the patient. The CSDD items were designed to be scored primarily on behavioral observation, rather than an elaborate interview with the patient. Thus, the scoring of the items does not rely heavily on the patient's subjective judgment or self-report of internal states such as complex ideational disturbance, and there are a limited number of such items on the scale. Each of the CSDD items is rated according to three explicitly defined grades: Absent: 0, Mild: 1, and Severe: 2, with a total summary score range of 0–38, with higher values representing greater severity of depressive symptoms. The time-frame evaluated is the previous week to the previous month, depending on the items assessed. A score of 13 or greater is indicative of major depression,[5] although a lower cut-off score of 6 is currently being examined as indicative of clinically significant depression, both major and minor, in persons with Alzheimer disease (AD; G.S. Alexopoulos, personal communication, July 1998).

Content validity and reliability. A series of studies[5,6] evaluating the psychometric properties of the CSDD with depressed patients and control subjects, including both cognitively intact and dementia patients, have been reported. The scale was found to have high internal and interrater reliabilities in both populations. Both the Cornell Group and other investigators have confirmed that the scale has a high level of concurrent validity relative to other measures of depression in patients with dementia.[8–10] Only eight patients in the dementia group were nursing home residents, however, and validation studies specifically excluded individuals with high levels of medical illness and functional disability.[5,6]

Subscale structure of the CSDD. Although the CSDD has been treated most frequently as a unidimensional instrument, the items were clustered originally into five groupings based on clinical meaningfulness but without an empirical basis.[5] A factor analysis (principal-components with a varimax rotation) of the

original CSDD conducted with a community-dwelling, probable AD population, yielded a four-factor solution (General Depression, Rhythm Disturbance, Agitation/Psychosis, and Vegetative Symptoms) that showed only moderate concordance with the five symptom clusters proposed in the original presentation of the CSDD.[11] No additional factor analyses on the CSDD have been reported since its original presentation, nor has the CSDD been studied in an older, frail nursing home population with high rates of co-existing dementia, medical illness, and functional disability. Thus, the current study afforded an opportunity, not only to further validate the instrument, but also to examine the potential importance of empirically derived depression symptom clusters in explaining the construct of depression in an older, frail nursing home population.

METHODS

Sample and Data Collection

The sample for the present study was drawn from a larger, longitudinal clinical trial of subjects recruited from three nursing homes in the greater Philadelphia area. The aim of that study was to reduce restraints in nursing homes.[12] The design, implementation, and analysis of the original clinical trial are described in detail elsewhere.[12] The sample used in the present study consisted of nursing home residents, with CSDD assessments completed immediately before the intervention. The parent study sample at this time period comprised 658 residents. Of these, 648 had sufficient CSDD data to compute a value for the original CSDD Total score, whereas 642 had complete data on all CSDD items, enabling factor analysis and representing 98% of the available patient data. The caregiver-informants for the study were both licensed and unlicensed members of the nursing staff in the nursing homes, who had cared for the subjects for a minimum of 1 month. Data were collected by two professional nurse research assistants trained in the use of the CSDD; interrater reliability was 0.95. The majority of the study subjects were female (82%) and English-speaking, with a mean (SD) age of 84.3 (7.6) years; range: 61–105 years. Subjects were moderately cognitively impaired (mean [SD] Mini-Mental State Exam [MMSE]: 14.3 [10.2]; range: 0–30), moderately functionally disabled (mean [SD] Psychogeriatric Dependency Rating Scale [PGDRS] Physical Functioning subscale score: 16.3 [9.6]; range: 0–34), and had a mean of seven physical illnesses (SD: 2.8; range: 0–17). The mean (SD) CSDD score was 4.7 (4.2), with a range from 0 to 26.

Procedure

The parent study protocol was approved by the University of Pennsylvania Committee on Studies Involving Human Beings and the administrative staff of the three nursing homes. Approval was granted before submission of the study for funding and re-approved each year of the study.

Statistical Methods

Factor analysis. We performed a secondary analysis of data from a longitudinal clinical trial designed to reduce restraints in nursing homes.[12] Pre-intervention data on depression from the CSDD were subjected to exploratory factor analysis with both orthogonal and oblique rotations. Factor analyses were implemented using SAS statistical software (Proc Factor, SAS Institute, Cary, NC). First, a principal-components analysis was performed to extract eigenvalues reflecting the number of underlying dimensions. The number of meaningful factors was determined by examining a scree plot[13] and evaluating the criterion of eigenvalues ≥ 1 as well as comparing the interpretability of three-, four-, and five-factor solutions from a clinical perspective. In conducting these analyses, loadings of ≥ 0.40 were judged to be significant and are noted in bold in Table 1. Inclusion of items with loadings of ≥ 0.40 in the interpretation of the data indicates that at least 16% or more of the variance in a given item has been explained by that factor.[14] The oblique rotation was performed because, a priori, it was expected that factors may be correlated. For the analyses reported here, all factor loadings exceeded 0.40, based on the final oblique rotation. To maximize potential future clinical usefulness, simple score indices were constructed for each set of items identified as part of each of the four domains.

Internal consistency. The internal-consistency reliabilities of constructed indices were assessed with Cronbach alpha statistics.[15]

Criterion validity. A total of 28 patient-related variables selected from the original dataset were used to

construct sets of criterion variables based on theoretical justification. After the four indices were generated from the factor analysis, we hypothesized that each index would be associated with variables from a particular set or sets. These hypotheses were then tested by computing Pearson correlation coefficients between derived indices and criterion variables. The three sets of criterion variables were identified as:

1. Psychiatric/behavioral: problem behavior (general), mental status function (global), orientation, elated affect, psychiatric diagnoses, delusions/hallucinations, demanding interaction, disruptiveness, noisiness, and restlessness.
2. Medical/treatment-related: falls risk, total number of medications, physical functioning, anemia, cerebrovascular accident, explicit terminal prognosis, summary of all health status changes, neurological disorder, total number of hospitalizations within 90 days, total number of days in bed within past 7 days, total number of medical diagnoses, self-rated health, gastrostomy tube within 90 days, and urinary catheter within 90 days.
3. Sleep disturbance-related: frequent incontinence of urine, night; frequent incontinence of feces, night; and awakened at night.

TABLE 1. Factor loadings in the rotated factor matrix of the CSDD ($N = 642$)

	Factor			
Item	**1**	**2**	**3**	**4**
Factor 1. Depression				
Pessimism	0.77	0.07	−0.03	0.05
Self-Depreciation	0.69	0.27	−0.14	0.10
Suicide	0.66	−0.01	0.02	−0.03
Sadness	0.47	−0.02	0.18	0.32
Mood-Congruent Delusions	0.43	−0.00	−0.08	0.21
Factor 2. Somatic/Vegetative				
Lack of Reactivity	0.57	0.71	−0.10	0.10
Weight loss	−0.074	0.65	0.16	−0.05
Lack of Energy	0.26	0.60	0.03	−0.25
Loss of Appetite	0.09	0.57	0.14	−0.10
Retardation	−0.29	0.56	−0.11	0.36
Factor 3. Disturbed Sleep				
Difficulty Falling Asleep	0.21	−0.06	0.76	−0.09
Multiple Awakenings	0.03	−0.01	0.76	0.14
Early Morning Awakening	−0.16	0.24	0.51	0.17
Factor 4. Anxiety				
Agitation	−0.04	−0.12	0.09	0.76
Irritability	0.33	−0.04	0.05	0.59
Anxiety	0.35	−0.02	0.28	0.43

Note: CSDD: Cornell Scale for Depression in Dementia.

RESULTS

Factor Analysis

Results of the oblique rotation are reported because this rotation yielded a simpler, conceptually clearer solution, with more clinically interpretable results than did orthogonal rotation.[16] The principal-factor solution yielded five factors with eigenvalues greater than 1.00, accounting for 50% of the variance. Factor 5 was dropped, however, because it barely met the standard inclusion criterion of an eigenvalue of ≥1.00 and because it did not account for at least 16% of the variance.[15] Moreover, the four-factor solution was more easily interpreted from a clinical perspective. Consequently, a four-factor solution was judged to be most appropriate for these data.

After oblique rotation, an initial four-factor rotated factor pattern matrix, estimated on the basis of all 19 items, yielded clinically interpretable domains that explained 46% of the variance. However, three items, (diurnal variation, multiple physical complaints, and loss of interest) had factor loadings of <0.40 on all four factors.[17] These items were deleted, and a final four-factor solution based on 16 items was obtained (Table 1). Factor 1 was labeled Depression; Factor 2, Somatic/Vegetative; Factor 3, Disturbed Sleep; and Factor 4, Anxiety.

Descriptive Statistics and Reliability of the 16-Item CSDD

The CSDD subscales based on the four factors were derived as simple summations of the relevant items.[15] Descriptive statistics and Cronbach's alpha internal-consistency reliability coefficients for the four factor-based subscales and the total 16-item scale are presented in Table 2.

The inter-factor correlation between the Depression factor and the Disturbed Sleep factor was 0.30. Thus, these two sets of symptoms had moderate tendencies to cluster within the same patients. The moderate size of this correlation also reflects the usefulness of the oblique rotation.[18] The orthogonal rotation incorrectly assumes that this correlation is equal to 0. All other inter-factor correlations were small (i.e., less than 0.181). The percentages of total variances explained by each of the factors, ignoring the remaining factors (and eliminating the remaining factors) were the following: Depression 17.7% (13.3%); Somatic/Vegetative 14.8%

(12.6%); Disturbed Sleep 12.9% (9.4%); and Anxiety 12.2% (10.3%).

Internal-Consistency Reliabilities

The internal-consistency reliabilities for the total 16-item CSDD (0.76), the Depression subscale (0.75), and the Somatic/Vegetative subscale (0.72) can be considered satisfactory and adequate for research purposes. In fact, a reliability coefficient of 0.70 has been found to be sufficient in the early stages of instrument development.[19] As is to be expected, the subscales with the fewest items, Disturbed Sleep and Anxiety, had the lowest reliability coefficients. Future research should be focused on testing of the CSDD in other samples to determine whether more items would improve the reliability coefficients.[20]

Criterion Validity

The criterion-validity examination found that the four indices correlated as expected with specific criterion variables (see Table 3). Scores on the Somatic/Vegetative and Disturbed Sleep indices correlated positively with medical/treatment- and sleep disturbance-related variables, whereas the scores on the "intrapsychic" indices (Depression and Anxiety) correlated positively with psychiatric/behavioral variables. However, the variable Self-Rated Health, included in the medical/treatment-related set of variables, correlated negatively with the Somatic Index scores as well as with scores on the intrapsychic indices. This finding is not surprising, given that there seems to be a complex pattern of association between self-ratings of health and measures of medical illness and depression.[21] Furthermore, the stronger association between the Anxiety factor and the Psychiatric–Behavioral variables, such as Agitation, was expected, given that manifestations of anxiety also may be similar to the agitation associated with dementia. Caution must be exercised in this interpretation in that agitation often is a symptom of depression with dementia and should be considered in the differential diagnosis of depression in nursing home residents and other patients.

DISCUSSION

The factor analysis yielded a 16-item instrument consisting of four factors or subscales. Table 2 notes the obtained range of scores for the 16-item CSDD and the subscales, compared with possible ranges. The mean score of the CSDD in this study is similar to the mean CSDD score reported in a community sample with probable AD.[11] However, the mean score is significantly lower than in the original reports. We propose several explanations. Foremost, the differences in study population from those in the original reports, in which a majority of the subjects had a diagnosed depression or were psychiatrically hospitalized, may account for a lower mean score in the current population. Another possibility is that an increased variability in mood and associated symptoms of depression in dementia patients could lead to an underreporting of depressive symptoms in caregiver reports that sample behavior during limited periods.[22] Also, it has been proposed that most of the depression in patients with AD is mild or minor.[20] Furthermore, the low mean score of the CSDD also may reflect a conservative rating of 0 or 1 by the observer for items when high rates of concurrent dementia, medical illness, and functional disability are present, to hedge against the "causation factor" dilemma as to whether depression and/or dementia, medical problems, or functional disability are causing a symptom.

Five items clustered on Factor 1 and reflected core psychological or "intrapsychic" features of depression in both the affective and cognitive realms. The items included Pessimism, Self-Depreciation, Suicide, Sadness, and Mood-Congruent Delusions, and accounted for 17.7% of the total item variance, ignoring correla-

TABLE 2. Descriptive statistics and reliability coefficients for the four factor-based subscales ($N = 642$)

Factor	Mean (standard deviation)	Potential Range	Obtained Range	Cronbach Alpha
Depression (5 items)	1.1 (1.7)	0–10	0–10	0.75
Anxiety (3 items)	1.5 (1.6)	0–6	0–6	0.61
Somatic/Vegetative (5 items)	1.6 (2.1)	0–10	0–9	0.72
Disturbed Sleep (3 items)	1.8 (1.1)	0–6	0–6	0.62
Total Scale (16 items)	5.1 (4.2)	0–32	0–26	0.76

tions with other factors. This subscale was named Depression. The items of this subscale are consistent with the literature on the phenomenology of depression in older adults with and without dementia[22,23] and do not support the supposition that patients with depression and dementia have fewer intrapsychic symptoms. Previous research also has found that nursing staff often are aware of mood symptoms of depression in nursing home residents even in the absence of major depression.[24] This is especially important because it has been proposed that the burden of depressive symptoms in nursing home residents, mostly non-major depressive symptoms, are usually apparent through reports of others.[23] Nursing home staff who interact and observe the older resident on a consistent basis also are more likely to witness expressions of sadness as well as more covert feelings of pessimism and low self-worth, both verbally and nonverbally.[23] These more subtle signs of depression may not be elicited from a single-session interview by a mental health consultant and are most likely expressed through interactions with caregivers over time. In a study of non-institutionalized older adults with similar levels of cognitive impairment,[25] psychological symptoms were reported to be more severe in female patients and in those individuals with a better understanding of their cognitive decline.

The five items clustering on Factor 2 were named Somatic/Vegetative because they reflected the common somatic and vegetative features associated with depression in late life in addition to similar symptoms that can be associated with medical illness or dementia. They included lack of reactivity, weight loss, lack of energy, loss of appetite, and retardation, and they accounted for 14.8% of the total variance.[5,6] Although an etiologic approach to rating symptoms of depression was recommended in the original reports, caregivers may be unable reliably to distinguish between somatic/vegetative symptoms in older adults with multiple medical illnesses, as well as functional disability and dementia. If somatic/vegetative symptoms due to medical illness, functional disability, or dementia did not vary independently of depression to a significant extent, one also

TABLE 3. Correlations among variables

	Depression	Anxiety	Somatic/Vegetative	Disturbed Sleep
Medical/Treatment-Related				
Falls, risk			0.25	0.22
Total number of medications			0.26	0.33
Physical functioning			0.15	0.12
Anemia			0.10	
Cerebrovascular accident			0.10	
Explicit terminal prognosis			0.10	
Health status changes: sum			0.30	
Neurological disorder			0.29	
Total number of hospitalizations			0.12	
Total number of days in bed			0.40	0.26
Total number of medical diagnoses			0.10	0.12
Gastronomy tube				0.16
Urinary catheter				0.10
Self-rated health	−0.33	−0.23	−0.27	−0.26
Psychiatric/Behavioral				
Problem behavior (global)	0.15	0.47		
Mental status (global)		−0.20		
Orientation	−0.13			−0.20
Elated affect	−0.27	0.19		
Psychiatric diagnoses	0.11	0.11		
Delusions/hallucinations	0.10	0.20		
Demanding interaction	0.17	0.33		
Disruptiveness	0.10	0.39		
Noisiness	0.10	0.42		
Restlessness		0.39		
Sleep Disturbance-Related				
Awakened at night				0.43
Frequent urinary incontinence, night				0.15
Frequent fecal Incontinence, night				0.21

would have expected these items to cluster with the other core depressive symptoms. With the "rule" used for scoring depressive symptoms in this study (symptoms were counted toward ratings of the severity of depression if they could not be solely and unambiguously attributable to medical illness), somatic/vegetative symptoms should not emerge as a separate factor from the depression factor in the analysis. The clear separation of somatic/vegetative features from the core depression factor in this study, therefore, raises questions about the validity of the CSDD in a population with high levels of medical illness, functional disability, or dementia. Several authors[10,26,27] have reported that caregivers may be less likely to distinguish between symptoms due to other medical and mental problems from those of depression. Moreover, studies with non-institutionalized older adults with similar levels of cognitive impairment[21,23,25] have suggested that psychological symptoms (versus somatic symptoms) specifically label the depressive syndrome in patients with dementia and that depression rating scales with a high somatic content may contribute to an overestimation of the prevalence of depression in such patients.[21,23,28] Contrasting these results with those of an earlier long-term care study[4] in which a factor analysis of the Ham-D in older adults was conducted, somatic or vegetative items did not emerge as a separate factor from the core depression factor. One explanation may be the differences in the study samples, in that the current study included subjects with higher levels of medical illness, functional disability, and cognitive impairment, thereby contributing to the difference in factor structures.

Difficulty falling asleep, multiple awakenings, and early-morning awakening comprised Factor 3, named Disturbed Sleep, which accounted for 12.8% of the variance. Caregivers may be unable to distinguish between sleep disturbance of depression and that associated with other factors. Inasmuch as sleep disturbance is an intuitively important dimension of depression, the clear separation of the Disturbed Sleep factor from the depression factor also suggests that these symptoms may not solely be related to depression. For example, within the nursing home setting itself, disturbed sleep may be explained by physical health problems, caregiver interruptions, circadian rhythm disturbance associated with AD, delusional thinking, pain syndromes, or as part of a primary sleep disorder of late life. Previous research also has reported that, in fact, sleep disturbance is a poor indicator of depression in older subjects, both with and without dementia.[29,30]

Factor 4, Anxiety, comprising agitation, irritability, and anxiety, accounted for 12.2% of the item variance. The items from this factor also support previous reports that anxiety frequently accompanies depression in older adults and that it is best identified through a surrogate, rather than self-report. Since agitation is another common symptom of depression in patients with dementia, it is therefore important to consider depression in agitated nursing home residents.[31] Conversely, Jost and Grossberg[32] recently proposed that irritability is less a symptom of depression in AD patients than it is related to AD processes themselves. This is in contrast with an earlier factor analysis of the Ham-D in a similar population,[4] in which a separate, clear anxiety factor also emerged.

Three of the original 19 CSDD items did not load on any of the four factors and were not strongly correlated with other items on the CSDD. The items "Loss of Interest," "Multiple Physical Complaints," and "Diurnal Variation" did not meet the required loading criterion of ≥ 0.40. The majority of subjects (>70%) scored 0 on these items. We propose some possible explanations. The fact that Loss of Interest did not load may reflect a "floor effect," in that passive participation in activities occurred in the face of a decline in interest secondary to a decline in physical or mental functioning. Moreover, for this item, the caregiver is asked to describe the resident's behavior observed during the week before the interview and any acute change within the past month. The caregiver who was interviewed may not have known the resident over this period of time, thereby contributing to an inability to accurately reflect changes in participation. In their original presentation,[5,6] the authors proposed that caregivers may be less likely to distinguish multiple physical complaints associated with depression from those associated with multiple medical illnesses or functional disability in this specific population and context. Diurnal variation also may be difficult to distinguish or assess in this specific context when staff may be present for only an 8-hour period per day and with little communication between shifts. In a recent study,[33] diurnal mood variation was not a common symptom of depression experienced by dementia patients, with a prevalence of only 9.7%. It also has been proposed[20] that most of the depression occurring in dementia patients was minor or moderate and mainly characterized by affective and ideational

symptoms. Therefore, diurnal variation, more frequently associated with severe depression, may not characterize the depression in this population, which accounts for the non-loading of this item.

A potential limitation of this study relates to the scoring of the CSDD. In the parent study, an "etiologic" approach to counting depressive symptoms was used, in that CSDD items were scored positively toward depression only when the symptoms could not be solely and unambiguously attributed to medical illness or functional disability. Given the uncertain reliability with which raters made this distinction, drawing conclusions with regard to separating somatic/vegetative from "intrapsychic" depressive symptoms in order to fully assess the severity of depression in a nursing home population would be difficult.

In conclusion, factor analysis of the CSDD in an older, frail nursing home population gives a four-factor solution: Depression, Somatic/Vegetative, Disturbed Sleep, and Anxiety. This finding is consistent with the results of the only other factor analysis conducted on the original CSDD with a community-dwelling, probable-AD population.[11] Contamination of the total CSDD with symptoms caused by dementia, medical illness, and/or functional disability in an older nursing home population may result in less precise identification of pure underlying depression, resulting in nonspecific screening for depression. Thus, our results suggest that depression scales that are less dependent on items highly sensitive to comorbid conditions and not necessarily associated with depression may be more appropriate for use with this population of frail elderly patients. However, it remains a difficult problem to differentiate physical symptoms relating to depression from the same symptoms alternatively attributable to dementia, medical illness, and/or functional disability. Future research will need to establish whether intrapsychic subscales such as the ones developed in this report may, in fact, be more useful than the global scale when measuring depression in a population with high rates of dementia, medical illness, and functional disability. That is, depression rating scales with fewer somatic/vegetative and disturbed-sleep items may, in fact, be more useful in assessing depression in this population, and these should be considered. Ultimately, improving detection of depression in frail nursing home residents would be a significant contribution toward improving the quality of care and quality of life for this underserved group.

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The Factor Structure of the Cornell Scale for Depression in Dementia Among Probable Alzheimer's Disease Patients

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The authors rated 137 outpatients with probable Alzheimer's disease (AD) on the Cornell Scale for Depression in Dementia (CSDD) as part of routine evaluation. Principal-factors analysis with varimax rotation resulted in a four-factor solution that accounted for 43.1% of the common variance. The four factors included general depression (lack of reactivity to pleasant events, poor self-esteem, pessimism, loss of interest, physical complaints, psychomotor retardation, sadness); rhythm disturbances (difficulty falling asleep, multiple night awakenings, early morning awakenings, weight loss, diurnal variation of mood); agitation/psychosis (agitation, mood-congruent delusions, suicide); and negative symptoms (appetite loss, weight loss, lack of energy, loss of interest, lack of reactivity to pleasant events). The observed factor structure showed moderate concordance with the five symptom clusters proposed in the original presentation of the CSDD. (Am J Geriatr Psychiatry 1998; 6:212–220)

Symptoms of depression are common among patients with Alzheimer's disease (AD). Depression in AD includes affective, cognitive, somatic, and behavioral symptoms, such as persistent and pervasive dysphoria, feelings of worthlessness, sleep disturbances, and psychomotor agitation or retardation.[1] The incidence of depressive symptoms in AD varies across studies; however, the prevalence of depressive disorders is generally reported to range from 10% to 20%.[2,3]

Assessment of patient psychopathology is usually based on clinical interview

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and observation with the patient. This clinical interview is a problem with dementia patients because a core aspect of the disorder is problems with memory. Patients may thus be unable to identify or accurately report symptoms of depression. Research shows that AD patients may report their signs of depression inaccurately; this inaccuracy is attributed to their low rate of endorsing symptoms.[4–7] Self-rating scales of depression also may often not be useful in assessing elderly patients with dementia. For example, Knesevich et al.[8] reported that 23% of subjects with mild dementia were unable to complete the Zung Depression Scale,[9] and Burke et al.[10] observed that the validity of the Geriatric Depression Scale[11] was compromised in patients with mild AD. Among cognitively impaired subjects, greater sensitivity to mood-related symptoms may be obtained through clinical information given by collateral informants.[4,5,7] Several assessment instruments of patient psychopathology based on collateral report now exist, including the Behavioral Pathology in Alzheimer's Disease Rating Scale (BEHAVE-AD)[12] and the Consortium to Establish a Registry for Alzheimer's Disease Behavior Rating Scale (BRS).[13] The most comprehensive measure of depressive symptoms in AD that incorporates clinical information from an informant is the Cornell Scale for Depression in Dementia (CSDD).[14]

The CSDD is a 19-item instrument using information gathered from an interview with both the patient and a caregiver or nursing staff member. Item selection was based on literature review on the phenomenology of depression in patients with and without dementia and information ascertained from a questionnaire administered to geriatric psychiatrists and other experts in the field.[14] The CSDD has been shown to be a more reliable scale of depressive symptoms than the Hamilton Rating Scale for Depression (Ham-D)[15] and the Dementia Mood Assessment Scale (DMAS)[16] among elderly patients with dementia.[17] Also, CSDD scores have demonstrated moderate-to-high correlations with clinical diagnoses of major depression according to Research Diagnostic Criteria[18] in elderly persons both with and without dementia.[14,19,20]

The signs and symptoms of depression measured by the CSDD scale are categorized by Alexopoulos et al.[14] in five content areas: mood-related signs (anxiety, sadness, lack of reactivity to pleasant events, irritability); behavioral disturbances (agitation, retardation, multiple physical complaints, loss of interest); physical signs (appetite loss, weight loss, lack of energy); cyclic functioning (diurnal variation of mood, difficulty falling asleep, multiple awakenings during sleep, early morning awakenings); and ideational disturbances (suicide, poor self-esteem, pessimism, mood-congruent delusions). Although the items assessed by the CSDD are thus classified into five categories, the basis for these clusters is not reported.[14]

Because the authors of the CSDD propose clinically meaningful groupings for items on the scale, it may be useful to investigate the extent to which analysis of empirical data support these groupings. The dimensions of psychopathology assessed by the CSDD are unclear, especially among patients with AD. Factor analysis is a technique that provides analysis of the relationships among groups of items on assessment instruments. Understanding differences in item loadings on factors found in such an analysis can help clinicians in interpreting patient ratings on specific items. A determination of the CSDD factor structure in a well-defined AD clinical population is thus desirable. The purpose of this study is to assess the factor structure of the CSDD in a group of patients with probable AD in order to better understand what the scale measures overall, what the individual items measure, and whether the logical groupings of items suggested by the scale's authors exist empirically.

METHODS

Research participants were 137 patients evaluated at an outpatient memory disorders clinic. All met diagnostic criteria for AD established by the *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition* (DSM-IV)[21] and the criteria for probable AD according to the NINCDS-ADRDA.[22]

The assessment of patient depression was part of an extensive psychiatric clinical interview conducted by bilingual psychiatrists specializing in geriatric psychiatry. The informants for this study were the primary family caregivers accompanying the patients to the clinic. Depressive symptoms were assessed by means of the CSDD.[14] Item scores range from 0 (absent) to 2 (severe), with a maximum score of 38 points. The suggested cutoff scores for the CSDD are 8 for mild depression and 12 for moderate depression.[14]

In order to assess level of cognitive impairment, patients were administered the Mini-Mental State Examination (MMSE)[23] by bilingual social workers. This scale has a maximum score of 30 points, with scores less than 24 suggesting significant cognitive dysfunction. In an extensive review of the literature, Tombaugh and McIntyre[24] presented evidence that the MMSE demonstrates satisfactory reliability and construct validity as a brief screen of cognitive functioning.

Intercorrelations of the ratings were used as input for the principal-components and principal-factors procedure available in the Statistical Package for the Social Sciences (Version 6.0).[25] Principal-components analysis was used to determine the number of meaningful components to retain for rotation. This number was determined by the criterion of an eigenvalue >1, supplemented by the scree test.[26] The scree test requires inspection of the slope of a plot of eigenvalues derived during factor extraction. During factor extraction, factors that represent meaningful sources of variance are associated with substantial decreases in the eigenvalues that follow. The slope of the line is sharply negative. When trivial or nonmeaningful factors are extracted, the change in eigenvalue is much smaller, resulting in a less steep slope. The junction at which this change occurs helps to determine how many factors should be retained for rotation. "Scree" refers to the conformation of this plot, which resembles the pile of rubble at the base of a sheer cliff. After the number of components was determined through this procedure, a principal-factors solution was obtained and rotated to both varimax and oblimin criteria. The factor intercorrelation matrix obtained from the oblimin rotation was examined to determine whether second-order factors would be useful in further understanding the CSDD factor structure. In order to assess the relationship of depressive symptoms to cognitive status, we calculated factor scores for each patient and correlated them with MMSE scores.

RESULTS

In this sample, the mean age for patients was 78.2 years (range: 63–95). Patients had an average duration of illness of 4.1 years (range: 0–14), an average mean MMSE score of 15.6 (range: 0–29), and an average of 10.4 years of education (range: 0–20). Seventy percent of the sample ($n = 96$) was female. In all, 69 patients (50.4%) were Hispanic; 68 (49.6%) were white and non-Hispanic. The mean CSDD score in this study was 5.2 (range: 0–25). As a group, 9% of the patients ($n = 13$) exhibited mild symptoms of depression (CSDD scores of 8–12); 11% ($n = 16$) evidenced moderate depressive symptoms (CSDD above 12). The coefficient alpha[27] of the CSDD was 0.86, which indicates high internal-consistency reliability.

In order to assess whether substantial ethnic differences on the CSDD might affect the factor analysis, mean item scores were compared between ethnic groups, with correction for age, education, and cognitive impairment. None of these comparisons was significant. We also compared directly factor structures for each subgroup and found similar factor solutions for both ethnic groups. Scores from both groups were therefore pooled for all subsequent analyses.

The names, means and standard deviations (SD), for each CSDD item for the combined sample are presented in Table 1. Mean ratings for individual items on the CSDD varied from a low of 0.06 (suicidal ideation) to a high of 0.56 (sadness; the overall range was 0–2). Table 1 also indicates the prevalence of the specific depressive symptoms, which ranged from a low of 5.1% (suicidal ideation) to a high of 45.3% (anxiety). The eigenvalues used to determine the number of factors to be retained and rotated are presented in Table 2, along with the percentages of variance accounted for and the cumulative percentage of variance accounted for by each factor.

Table 2 shows that six factors had eigenvalues greater than 1.0, and rotated factor solutions including five and six factors were examined. These factors were judged to be trivial or nonmeaningful, for example, including only one item. Consequently, a four-factor solution was judged to be most appropriate for these data. Item communalities are presented in Table 3. Inspection of solutions rotated to oblimin criteria did not suggest substantially different structures from those presented below and are not presented here.

The factor loadings for each variable after rotating to varimax criteria are pre-

TABLE 1. Means ± standard deviations (SD) and prevalence of CSDD items (range: 0–2)

Factor/Item	Mean ± SD	Percent[a]
1. Anxiety	0.55 ± 0.66	45.3
2. Sadness	0.56 ± 0.70	43.8
3. Lack of reactivity	0.32 ± 0.59	25.5
4. Irritability	0.48 ± 0.62	41.6
5. Agitation	0.26 ± 0.55	21.2
6. Retardation	0.33 ± 0.56	28.5
7. Multiple physical complaints	0.10 ± 0.32	8.8
8. Loss of interest	0.47 ± 0.63	39.4
9. Appetite loss	0.23 ± 0.53	17.5
10. Weight loss	0.19 ± 0.48	15.3
11. Lack of energy	0.34 ± 0.57	29.2
12. Diurnal variation of mood	0.16 ± 0.44	13.1
13. Difficulty falling asleep	0.20 ± 0.53	13.9
14. Multiple awakenings	0.25 ± 0.51	21.2
15. Early morning awakenings	0.19 ± 0.51	13.7
16. Suicidal ideation	0.06 ± 0.27	5.1
17. Poor self-esteem	0.19 ± 0.43	17.5
18. Pessimism	0.25 ± 0.48	22.6
19. Mood-congruent delusions	0.10 ± 0.41	6.6

Note: CSDD = Cornell Scale for Depression in Dementia.

[a]Percentages are based on number of subjects with specific depressive symptoms graded as present (mild or severe).

TABLE 2. Eigenvalues, percentages of variance accounted for by factors, and cumulative percentages of variance for the principal-components solution

Factor/ Item	Eigenvalue	Percent of Variance	Cumulative Percentage
1	5.29	27.9	27.9
2	1.93	10.1	38.0
3	1.70	8.9	46.9
4	1.39	7.3	54.2
5	1.25	6.6	60.8
6	1.01	5.3	66.1
7	0.91	4.8	70.9
8	0.81	4.3	75.2
9	0.73	3.8	79.0
10	0.65	3.4	82.4
11	0.59	3.1	85.5
12	0.53	2.8	88.3
13	0.44	2.3	90.7
14	0.42	2.2	92.9
15	0.35	1.9	94.7
16	0.33	1.7	96.5
17	0.27	1.4	97.9
18	0.27	1.3	99.2
19	0.15	0.8	100.0

sented in Table 4. The principal-factors solution accounted for 43.1% of the common variance. Factor loadings greater than or equal to an absolute value of 0.40 were judged to be significant and are indicated by bold font in Table 4. Table 4 also includes the internal-consistency reliability of the four factors based on items with significant factor loadings and the association of the factors with MMSE score. The alpha coefficients for the four factors are all acceptable (>0.65). None of the factors correlated significantly with level of cognitive dysfunction. However, total CSDD scores showed a significant inverse relationship with total MMSE scores ($r = -0.25$; $P < 0.01$).

The four factors include general depression (lack of reactivity to pleasant events, poor self-esteem, pessimism, loss of interest, physical complaints, psychomotor retardation, sadness); rhythmic disturbances (difficulty falling asleep, multiple night awakenings, early morning awakenings, weight loss, diurnal variation of mood); agitation/psychosis (agitation, mood-congruent delusions, suicide); and negative symptoms (appetite loss, weight loss, lack of energy, loss of interest, lack of reactivity to pleasant events). Item 1, anxiety, and Item 4, irritability, did not significantly load on any of the factors in the analysis.

TABLE 3. Communalities for Cornell Scale for Depression in Dementia (CSDD) items in principal-factors solution

Factor/Item	Communality
1. Anxiety	0.16
2. Sadness	0.43
3. Lack of reactivity	0.73
4. Irritability	0.18
5. Agitation	0.49
6. Retardation	0.41
7. Multiple physical complaints	0.22
8. Loss of interest	0.45
9. Appetite loss	0.36
10. Weight loss	0.44
11. Lack of energy	0.47
12. Diurnal variation of mood	0.28
13. Difficulty falling asleep	0.44
14. Multiple awakenings	0.42
15. Early morning awakenings	0.49
16. Suicidal ideation	0.42
17. Poor self-esteem	0.54
18. Pessimism	0.54
19. Mood-congruent delusions	0.72

DISCUSSION

The data suggest that the CSDD measures a broad range of signs and symptoms of depression that are empirically represented by four independent symptom clusters among probable AD patients. The four observed factors are characterized by general depression, rhythmic disturbances, agitation/psychosis, and negative symptoms. These factors showed moderate consistency with the five categories of depressive symptoms proposed by Alexopoulos and colleagues.[14]

The first factor is composed of items primarily tapping the typical syndrome of depression. Symptoms loading on this factor included lack of reactivity to pleasant events, poor self-esteem, pessimism, loss of interest, psychomotor retardation, physical complaints, and sadness. This factor did not correspond with one specific symptom category as described by Alexopoulos et al.[14] This factor includes symptoms classified by them in several categories, including mood-related signs (lack of reactivity, sadness), behavioral disturbances (physical complaints, psychomotor retardation), and ideational disturbances (poor self-esteem, pessimism).

The second factor includes symptoms suggesting disturbances of biological rhythms. These include sleep disturbances (difficulty falling asleep, multiple awakenings during sleep, early morning awakenings), weight loss, and diurnal variation of mood. This factor corresponded closely with the symptom-grouping termed "cyclic functions" by Alexopoulos et al.,[14] although these results suggest that weight loss may also be associated with these

other problems. This "rhythmic disturbances" factor found is similar to a "vegetative features" factor reported by the CERAD.[13] They found that several symptoms suggesting disturbances of biological rhythms, such as altered sleep pattern, trouble falling asleep, tiredness, and change of appetite were connected. The present study thus confirms that these symptoms may often co-occur among AD patients.

The third factor corresponded to agitation, psychosis, and suicidal ideation. Although the interrelationship of these three divergent symptoms has not been reported among dementia patients, it has been observed in depressed patients without dementia. Nelson et al.[28] reported that suicidal ideation was more common among patients with psychotic than nonpsychotic depression in a heterogeneous sample of depressed patients (without dementia). Roose et al.[29] found that patients with depression and delusions were five times more likely to commit suicide than nondelusional depressed patients. Also, Cleary and Guy[30] factor-analyzed a 23-item version of the Ham-D[15] among a heterogeneous sample (age 18–60) of 480 patients with a diagnosis of neurotic depression. The authors reported a factor that included suicide, agitation, and paranoid symptoms.[30]

The relationship between delusions and agitation is consistent with other dementia research; psychosis has often been associated with symptoms of agitation among patients with AD.[31–33] Research addressing the general phenomenology of depression has shown elevated agitation in delusional, unipolar depressed patients, compared with nondelusional depressed patients.[34,35] It has also been demonstrated that elderly patients (≥60 years old) without dementia and with unipolar depression may be more likely to be delusional and agitated than younger depressed patients.[36]

TABLE 4. Loadings for principal-factor solution: varimax rotation

Factor/Item	1	2	3	4
1. Anxiety	26	30	04	−02
2. Sadness	**63**	09	02	18
3. Lack of reactivity	**67**	16	17	**47**
4. Irritability	10	28	20	24
5. Agitation	05	36	**60**	06
6. Retardation	**45**	13	29	32
7. Multiple physical complaints	**43**	18	03	−04
8. Loss of interest	**47**	02	04	**47**
9. Appetite loss	01	30	10	**51**
10. Weight loss	−06	**40**	−04	**53**
11. Lack of energy	30	04	31	**54**
12. Diurnal variation of mood	17	**49**	05	12
13. Difficulty falling asleep	23	**58**	21	08
14. Multiple awakenings	18	**59**	08	19
15. Early morning awakenings	15	**66**	01	17
16. Suicidal ideation	08	−12	**59**	22
17. Poor self-esteem	**71**	17	−04	−04
18. Pessimism	**64**	33	13	12
19. Mood-congruent delusions	01	19	**83**	−001
Coefficient alpha	0.81	0.74	0.68	0.73
Correlation (*r*) of MMSE with factor scores[a] (*P*-value)	−0.14 (0.11)	−0.13 (0.14)	−0.08 (0.37)	−0.13 (0.12)

Note: Decimals (except those in *P* and *r* values) are omitted. Loadings in bold indicate assignment of items to factors. MMSE = Mini-Mental State Exam.

[a]Pearson product-moment correlation coefficients.

The fourth factor was represented by physical disturbances, in addition to several symptoms characterizing the negative behavioral manifestations of AD. Both of the appetite items on the CSDD loaded on this factor (appetite changes and weight loss). Appetite disturbances are common symptoms, observed in 12%[37] to 70%[38] of dementia patients. The negative symptoms associated with this factor included lack of reactivity to pleasant events, lack of energy, and loss of interest. These symptoms are often witnessed among AD patients, and it has been argued that they may represent symptomatology associated with a dementing disorder rather than clinical manifestations of a depressive disorder.

None of the factor scores correlated with the level of cognitive deficits. However, CSDD total scores showed a weak but significant inverse relationship with MMSE scores. The literature is inconclusive regarding the relationship between depressive symptomatology and cognitive impairment among dementia patients. For example, some studies have shown depression to be more common in mild dementia than in moderate or severe dementia,[7,39,40] whereas others have reported no association.[5,6,16,37] The results of this study are consistent with investigations that have reported increased symptoms of depression among patients evidencing greater cognitive deficits.[8,41,42]

The factor structure described here is based on ratings both from depressed and nondepressed patients; this dual basis may be a limitation of the study. The factor structure of the CSDD might be different if it were assessed in a more homogeneous group of patients with diagnosable depression. Because the CSDD is often used for initial or screening evaluations, however, determination of its factor structure in a group of patients with differing levels of depressive symptomatology also is useful. Future research may clarify this issue.

Another limitation stems from our use of ratings from both Hispanic and non-Hispanic patients. Although our initial tests did not show significant differences in CSDD ratings on individual items, and we subsequently pooled ratings for this analysis, others have found cross-ethnic differences in expression of depressive symptoms among elderly persons without dementia.[43] Future research will clarify possible cross-ethnic differences in patterns of depressive symptoms and their effects on the factor structure of the CSDD.

In conclusion, results show empirical evidence of four factors or item groupings on the CSDD. The factors observed in this study showed moderate consistency with the five symptom categories proposed by Alexopoulos et al.[14] in the original presentation of the CSDD. Our results suggest that the subscales indicated by the authors of the CSDD should be interpreted with caution. Without replication, our findings should also be interpreted cautiously, but these empirically derived item groupings may eventually prove useful in understanding patterns of depressive symptoms among AD patients. Future studies will investigate whether the factor structure of the CSDD is stable across different ethnic and diagnostic groups.

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