Validity of the SF-36 Five-Item Mental Health Index for Major Depression in Functionally Impaired, Community-Dwelling Elderly Patients

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OBJECTIVES: To examine criterion and construct validity of the five-item Mental Health Index (MHI-5) of the 36-item Short Form health survey (SF-36) in relation to the presence of major depression in functionally impaired, community-dwelling elderly patients and of eight subsamples defined by cognitive functioning, levels of functional impairment, and proxy report versus self-report.

DESIGN: Cross-sectional observational.

SETTING: Nineteen counties in western New York, West Virginia, and Ohio.

PARTICIPANTS: One thousand four hundred forty-four functionally impaired, community-dwelling Medicare beneficiaries aged 65 and older who participated in the Medicare Primary and Consumer-Directed Care Demonstration.

MEASUREMENTS: MHI-5, Mini-International Neuropsychiatric Interview Major Depressive Episode (MINI-MDE) module.

RESULTS: The MHI-5 demonstrated sufficient criterion validity (area under the receiver operating characteristic curve = 0.837; sensitivity = 78.7% and specificity = 72.1% using a cutpoint of 59/60) with respect to the presence of depression for the entire sample. A significant correlation between MHI-5 scores and presence of major depression as identified using the MINI-MDE (Spearman correlation = -0.426, $P<.001$), a strong correlation between the MHI-5 and the SF-36 role emotional scale (Spearman correlation = 0.522) and a weak correlation with the SF-36 physical functioning scale (Spearman correlation = 0.133) provided evidence for construct validity. Additional evidence is provided by decline in mean MHI-5 score as level of formal education and number of close friends and relatives decreased. All eight subsamples demonstrated similar criterion and construct validity. A Cronbach alpha of 0.794 demonstrated internal consistency reliability.

CONCLUSION: This study provides evidence for adequate criterion and construct validity of the MHI-5 in relation to the presence of major depression among functionally impaired, community-dwelling elderly Medicare patients. **J Am Geriatr Soc 53:1978–1985, 2005.**

Key words: depression; SF-36; validity; elderly; functional impairment

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In recent decades, there has been increasing recognition of depression as a major public health problem for young and old alike.[1] Specifically, depression affects between 8% and 20% of elderly Americans residing in the community.[1] Late-life depression increases risk for suicide[2] and all-cause mortality;[3] has substantial detrimental effects on physical,[4] mental,[5] and social functioning;[6] is associated with cognitive impairment;[7] and is related to greater healthcare services use and costs.[6]

Increasing recognition of the need to collect health-status information at regular intervals has resulted in the periodic administration of health-status and health-related quality-of-life measures.[8] Perhaps the most highly used measure of health-related quality of life is the 36-item Short Form (SF-36) health survey.[9] The SF-36 includes eight brief scales, one of which, the five-item Mental Health Index (MHI-5), measures mental health status. Furthermore, the MHI-5 has been employed to identify depression.[10,11] Thus, the regular collection of the SF-36 offers the opportunity to easily, periodically, and relatively inexpensively examine the prevalence of depression.

Researchers have examined the association between the MHI-5 and depression in a number of studies,[12–17] the most prominent of which used data from the Medical Outcomes Study (MOS),[9,18–20] but most of these studies included no subjects aged 65 and older[12,13,15,16] or had only a small proportion of elderly subjects.[18,20] Only 6% of the 502 MOS patients with clinical depression were aged 65 and older—a total of 30 patients.[9]

One study[14] used data on participants in an antidepressant trial to examine the validity of the MHI-5 for

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depression in outpatients aged 60 to 86 (mean age 67) with *Diagnostic and Statistical Manual of Mental Disorders (DSM), Third Edition, Revised,* criterion for major depression and a Hamilton Depression Rating (HAM-D) scale score greater than 16. Construct validity for the MHI-5 was shown by significant associations with the HAM-D, the Clinician's Global Impression of Depression Severity measure, and the 30-item Geriatric Depression Scale, as well as through significant monotonic decreases in mean MHI-5 score as HAM-D score and Clinician's Global Impression of Depression Severity increased. Strong associations between the MHI-5 and the four SF-36 scales that had in earlier studies been best shown to measure mental health also demonstrated construct validity, whereas predictive validity was shown in relationship with outpatient and inpatient mental health services. This study excluded persons with serious or unstable comorbid medical conditions and patients with substantial cognitive impairment. It also included few old-old ($\geq$85) patients.[21]

Thus, to the best of the authors' knowledge, the association between the MHI-5 and major depression has not been investigated specifically for functionally impaired, community-dwelling elderly patients. They are also not aware of any studies that have examined the association between the MHI-5 and major depression in relation to cognitive functioning or level of functional impairment. The present study examined criterion and construct validity of the MHI-5 with respect to the presence of major depression in a population of functionally impaired, community-dwelling Medicare beneficiaries aged 65 and older.

METHODS

Study Sample

The Medicare Primary and Consumer-Directed Care Demonstration[22] was a randomized, controlled trial that included 1,605 primary care patients. In the study presented here, the 161 persons younger than 65 were excluded because the goal was to study the performance of the MHI-5 in older people. The study sample therefore consisted of 1,444 community-dwelling adults aged 65 and older.

Patients enrolled in the demonstration in 19 counties in New York, West Virginia, and Ohio between July 1998 and June 2000. All demonstration participants were required to have a high level of functional impairment (need or receive help for $\geq$2 activities of daily living (ADLs) or $\geq$3 instrumental ADLs) and to have had recent significant health services use (had been a hospital or nursing home inpatient, received Medicare home healthcare during the previous year, or had $\geq$2 emergency room visits during the previous 6 months).

Patient recruitment procedures are reported elsewhere.[23] The data presented in this article were collected in the patients' homes before randomization. A cognitive screen administered at the beginning of the interview assessed cognitive impairment. Caregivers provided the responses to the questions for 351 patients who were so cognitively impaired that it was believed that they could not provide accurate information.

Measures

Mental Health Index

The MHI-5 is one of the eight scales that constitute the SF-36 and consists of the following five questions "How much of the time in the previous 4 weeks: have you been a very nervous person? have you felt so down in the dumps that nothing could cheer you up? have you felt calm and peaceful? have you felt downhearted and blue? have you been a happy person?" The five response categories of Version 2 of the SF-36 (all, most, some, a little, or none of the time) were used. After coding, adding, and transforming, MHI-5 scores can range from 0 (worst) to 100 (best mental health).

MINI-MDE Module

Individuals were identified as having major depression if they had at least one of the two major symptoms for major depression (depressed mood or anhedonia) and had at least five of the nine symptoms. The MINI-MDE[24] has been found to have good concordance with two common criterion standard measures of psychopathology.[25] Several of the individual questions were modified, and the time period was extended from the previous 2 weeks to more than 2 weeks in the previous month.

Cognitive Performance Scale

The Cognitive Performance Scale (CPS)[26] is an interviewer-administered measure of cognitive functioning with a range of 0 (no cognitive impairment) to 6 (very severe impairment). CPS scores have been found to correspond closely with those of the Mini-Mental State Examination and the Test for Severe Impairment and with diagnoses of Alzheimer's disease and other dementias.[26,27]

Dependence in ADLs

ADL dependence[28] during the prior 7 days was assessed by asking the patient or the caregiver about six functions: transferring from bed to chair, toileting, dressing, bathing, eating/feeding, and walking. The responses for each ADL were used to classify each individual as dependent (1) or not dependent (0) for that ADL and then added to obtain the number of ADLs (0–6) in which each subject was dependent.

Analytic Methods

Analyses included calculation of descriptive statistics for the MHI-5 and examination of its criterion and construct validity and internal consistency reliability. Analyses were conducted using SAS 8.2 (SAS Institute, Inc., Cary, NC), Stata 8.0 (Stata Corp., College Station, TX), and SPSS 12.0 (SPSS Inc., Chicago, IL) statistical packages.

Criterion validity for the MHI-5 was explored, with major depression (depressed vs not depressed) identified by the MINI-MDE as the criterion. Specifically, criterion validity was measured using the area under the receiver operating characteristic curve (AUC)[29] and the sensitivity and specificity of specific cutscores.

Construct validity for the MHI-5 was investigated in three ways. First, the Spearman correlation between the MHI-5 score and the presence of depression was examined as indicated using the MINI-MDE. Second, the Spearman correlations between the MHI-5 score and each of the other seven SF-36 scales were compared. In particular, it was

expected that the MHI-5 would have the highest correlations (convergent construct validity) with the scales recognized as mental health scales (role emotional and social functioning) and the lowest correlations (divergent construct validity) with those recognized as physical health scales (physical functioning, role physical, and bodily pain). The expectation was that the remaining scales (general health perceptions and vitality) would have correlations intermediate in strength between those with the mental and physical scales. Third, the mean MHI-5 scores for sociodemographic variables whose subgroups it was expected would have significantly different MHI-5 means were compared. Specifically, based on earlier studies,[13,17] it was anticipated that poorer mental health status (lower mean MHI-5 score) would be associated with older age, female sex, being widowed or separated/divorced, less education, not owning one's home, living alone, having few close friends, and having few close relatives. Analysis of variance was employed to compare the means for each of the subgroups for each of these variables.

Internal consistency reliability of the MHI-5 was assessed using Cronbach alpha coefficient.

Because cognitive impairment is prevalent in older people and might affect the validity and reliability of the MHI-5, subgroup analyses were performed in which patients who were cognitively intact (CPS score of 0–1) were compared with those who were cognitively impaired (CPS score of 2–6).

Degree of ADL impairment might affect the validity and reliability of the MHI-5. Thus, subgroup analyses were conducted to compare MHI-5 performance between patients with less (dependence in 1–3 ADLs) and greater (dependence in 4–6 ADLs) functional impairment.

Because it was anticipated that validity might differ for patients with cognitive impairment whose MHI-5 was completed by a proxy (n = 257) from that of those completed by the cognitively impaired patients themselves (n = 226), validity was examined separately for these two groups. Validity was also separately investigated for subject-reported and proxy-reported patients in those with greater functional impairment.

RESULTS

Patient Characteristics

The mean age of the 1,444 study patients was 80.5; 70% were female, and 3% were minorities. Slightly more than half rated their health as fair or poor. Because of the demonstration project's eligibility criteria, the sample experienced high functional impairment (mean ADL dependence = 2.4; mean instrumental ADL dependence = 4.6). A total of 27.4% were cognitively impaired, and 15.7% had major depression (Table 1).

Descriptive Statistics

The mean MHI-5 score ± standard deviation was 67.5 ± 20.5 (range 0–100) for the entire sample and ranged from 63.4 to 68.4 for the eight subsamples (Table 2). It was significantly lower (worse) ($P < .001$) for patients identified as having major depression (45.1 ± 19.7) than for those without major depression (71.7 ± 17.7).

Criterion Validity

Employing major depression as identified using the MINI-MDE as the criterion, it was found that the AUC for the MHI-5 was 0.837 for the entire sample (Figure 1). This supports the criterion validity of the MHI-5 in successfully differentiating between depressed and nondepressed patients. Although the AUC ranged from 0.815 to 0.899, it was about 0.83 for most of the eight subsamples (Table 2).

A cutpoint of 59/60 provided optimal sensitivity and specificity for the entire sample. Using this cutpoint, the MHI-5 demonstrated adequate sensitivity (78.7%) and specificity (72.1%). Although sensitivity did not differ much across the eight subsamples when this cutpoint was employed, specificity varied much more and was low (under 70%) for four subsamples. By far the highest specificity (84.4%) occurred for patient-reported cognitively impaired patients (Table 2). The optimal cutpoint for six of the eight subsamples was 59/60. The two exceptions were patient-reported cognitively impaired patients, with an optimal cutpoint of 47/48 (sensitivity = 89.2%, specificity = 78.1%) and proxy-reported cognitively impaired patients, with 63/64 (sensitivity = 72.2%, specificity = 71.4%).

Construct Validity

Evidence for construct validity was provided in three ways. First, it was demonstrated using a statistically significant association between the MHI-5 and the presence of depression as indicated by the MINI-MDE for the entire sample (Spearman correlation = -0.426, $P < .001$) and for each of the eight subsamples ($P < .001$ for each) (Table 2).

Second, although significant correlations between the MHI-5 and other SF-36 scales indicated evidence of construct validity, this was not as strong as anticipated because the strength of correlations for specific scales was not always as had been expected. One of the two scales that were expected would have the highest correlations with the MHI-5 (the role emotional scale) demonstrated convergent construct validity. One of the three scales that were expected would have the lowest correlations with the MHI-5 (physical functioning) showed divergent construct validity. Alternatively, one of the two scales that were expected would have the highest correlations with the MHI-5 (social functioning) and two of the three scales that were expected would have the lowest correlations (bodily pain and role physical) had correlations intermediate in strength. These correlations were similar to those of the two scales (general health perceptions and vitality) that were anticipated would be intermediate in strength. With only a few exceptions, the strength of the correlations between the MHI-5 and the SF-36 scales did not differ appreciably across the entire sample and the eight subsamples (data not presented; available from the authors upon request).

Third, the significant association between several sociodemographic variables indicated additional support for construct validity with the MHI-5 in the expected direction. For the entire sample, as the level of formal education, number of close friends, and number of close relatives declined, so did the average MHI-5 score. Although similar patterns occurred in many of the eight subsamples, with several exceptions statistically significant relationships

Table 1. Patient Characteristics (N = 1,444)

Characteristic	Value
Sociodemographic	
Age	
Mean ± SD (range)	80.5 ± 7.6 (65–103)
65–74, n (%)	346 (24.0)
75–84, n (%)	633 (43.8)
≥85, n (%)	465 (32.2)
Sex, n (%)	
Male	432 (29.9)
Female	1,012 (70.1)
Ethnicity, n (%)	
Nonwhite	44 (3.0)
White	1,400 (97.0)
Education, n (%)	
<High school	594 (41.1)
High school graduate	451 (31.2)
>High school	399 (27.6)
Annual household income, $, n (%)	
<10,000	459 (31.8)
10,000–19,999	524 (36.3)
≥20,000	461 (31.9)
Housing, n (%) (N = 1,441)	
Patient owns	849 (58.9)
Patient's family owns	242 (16.8)
Other	350 (24.3)
Site, n (%)	
New York	989 (68.5)
West Virginia and Ohio	455 (31.5)
Rural/urban, n (%)	
Rural	412 (28.5)
Urban	1,032 (71.5)
Social support, n (%)	
Marital status	
Married	587 (40.6)
Widowed	729 (50.5)
Separated or divorced	80 (5.5)
Never married	48 (3.3)
Living arrangement	
Alone	555 (38.4)
Not alone	889 (61.6)
Number of friends (other than spouse) feel close to, n (%) (N = 1,435)	
0–1	468 (32.6)
2–5	659 (45.9)
≥6	308 (21.5)
Number of relatives (other than spouse) feel close to, n (%) (N = 1,435)	
0–1	267 (18.6)
2–5	687 (47.9)
≥6	481 (33.5)
Health insurance, n (%)	
Medicaid	
Yes	121 (8.4)
No	1323 (91.6)
Medi-Gap	
Yes	1,054 (73.0)
No	390 (27.0)
Health maintenance organization	
Yes	172 (11.9)
No	1,272 (88.1)

(*Continued*)

Table 1. (Contd.)

Characteristic	Value
Health status	
Self-rated health, n (%)	
Excellent to very good	185 (12.8)
Good	450 (31.2)
Fair	559 (38.7)
Poor	250 (17.3)
Chronic conditions	
Mean ± SD (range)	4.5 ± 2.2 (0–13)
Hypertension or high blood pressure, n (%)	956 (66.2)
Arthritis of the hip or knee, n (%)	886 (61.4)
Arthritis of the hand or wrist, n (%)	721 (49.9)
Other heart conditions, n (%)	545 (37.7)
Angina pectoris or coronary artery disease, n (%)	527 (36.5)
Stroke, n (%)	418 (29.0)
Congestive heart failure, n (%)	417 (28.9)
Diabetes mellitus, n (%)	394 (27.3)
Chronic obstructive pulmonary disease, n (%)	387 (26.8)
Sciatica, n (%)	387 (26.8)
Myocardial infarction, n (%)	386 (26.7)
Cancer (except skin cancer), n (%)	314 (21.8)
Inflammatory bowel disease, n (%)	187 (13.0)
Body mass index, n (%) (N = 1,396)	
≤18.5 (underweight)	136 (9.7)
18.6–24.9 (normal)	582 (41.7)
25–29.9 (overweight)	358 (25.6)
≥30 (obese)	320 (22.9)
Bodily pain in the previous 4 weeks, n (%) (N = 1,435)	
None to mild	564 (39.3)
Moderate	503 (35.0)
Severe to very severe	368 (25.6)
36-item Short Form Physical Component Summary score, mean ± SD (range)	30.8 ± 9.1 (11.1–63.3)
Number of activities of daily living dependent in, mean ± SD (range)	2.4 ± 1.8 (0–6)
Number of instrumental activities of daily living dependent in, mean ± SD (range)	3.6 ± 1.8 (0–6)
Mental health	
Major depressive episode, n (%) (N = 1,436)	
Yes	226 (15.7)
No	1,210 (84.3)
Cognitive Performance Scale score	
Mean ± SD (range)	1.3 ± 1.4 (0–6)
0, n (%)	442 (30.6)
1, n (%)	606 (42.0)
2–6, n (%)	396 (27.4)

SD = standard deviation.

were not detected at conventional levels ($P < .05$ or lower), perhaps because the sample sizes were smaller. Age, marital status, housing, and living situation (living alone vs with others) were not associated with mean MHI-5 score for the entire sample or for the eight subsamples, and sex had a significant association for only one subsample (data not presented; available from the authors upon request).

DISCUSSION

To the authors' knowledge, this is the first study to examine the validity of the MHI-5 in relation to the presence of major depression in functionally impaired, community-dwelling elderly Medicare beneficiaries. Limitations of the study include the use of a brief questionnaire (the MINI-MDE) to identify the presence of major depression rather than employment of a longer semistructured or structured diagnostic interview such as the Structured Clinical Interview for the DSM that results in a DSM diagnosis of major depression. The MINI-MDE was employed given concerns about potential burden associated with use of semistructured or structured interviews for functionally impaired older adults. A second limitation was that the present study included only Medicare beneficiaries with functional impairment and recent significant health services use, so it may not be generalizable to the entire elderly Medicare

Table 2. Descriptive Statistics, Criterion Validity, Construct Validity, and Internal Consistency Reliability for the five-Item Mental Health Index

Descriptive Statistics, Validity, and Reliability Measures	Entire Sample (N = 1,444)	Cognitively Intact (n = 961)	Cognitively Impaired			1 to 3 ADLs (n = 801)	4 to 6 ADLs		
			All (n = 483)	Patient Reported (n = 226)	Proxy Reported (n = 257)		All (n = 368)	Patient Reported (n = 218)	Proxy Reported (n = 150)
With MINI-MDE, n	1,436	960	476	226	250	799	364	218	146
Descriptive statistics									
Mean	67.54	68.44	65.75	66.25	65.31	68.42	65.21	66.44	63.41
Standard deviation	20.46	19.65	21.88	22.01	21.80	19.78	21.39	20.38	22.72
Skewness	− 0.59	− 0.57	− 0.59	− 0.60	− 0.57	− 0.62	− 0.52	− 0.50	− 0.50
Kurtosis	2.80	2.79	2.68	2.67	2.69	2.92	2.60	2.61	2.47
Minimum	0	0	0	8	0	0	8	8	8
Maximum	100	100	100	100	100	100	100	100	100
Number at floor	3	2	1	0	1	2	0	0	0
Number at ceiling	65	43	22	14	8	34	14	9	5
Criterion validity*									
Area under the receiver operating characteristic curve	0.837	0.835	0.839	0.899	0.815	0.835	0.835	0.825	0.851
Sensitivity, %	78.68	78.59	78.88	78.35	79.44	79.37	78.85	76.80	82.65
Specificity, %	72.12	72.58	71.57	84.38	65.71	74.53	68.24	67.57	68.75
Construct validity									
Correlation with the MINI-MDE	− 0.426	− 0.390	− 0.482	− 0.483	− 0.491	− 0.394	− 0.491	− 0.424	− 0.572
(*P*-value)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Internal consistency reliability									
Cronbach alpha	0.794	0.784	0.810	0.802	0.819	0.778	0.809	0.788	0.834

* Uses the Mini-International Neuropsychiatric Interview Major Depressive Episode (MINI-MDE) Module as the criterion with a cutpoint of 59/60.
ADL = activity of daily living.

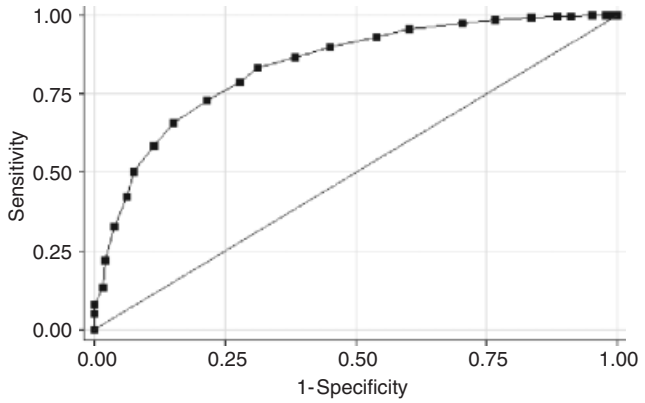

Figure 1. Criterion validity area under the receiver operating characteristic curve (0.8372) for five-item Mental Health Index score in relation to the presence of major depression.

population, although functionally impaired, community-dwelling Medicare beneficiaries are of great interest to Medicare as well as to healthcare researchers and policy makers.

The mean MHI-5 score of 67.5 for the entire study population was lower than the mean of 76.6 reported for another chronically ill population, 969 MOS patients.[19] In the present study, the mean MHI-5 score of 45.1 for the patients with major depression was close to the means reported for two other groups of depressed patients (46.3 for 502 MOS patients with clinical depression[9] and 45.6 for 97 MOS patients with clinical depression and no serious chronic medical conditions),[20] although it was lower (worse) than the means for four other groups of depressed patients: 153 MOS patients with clinical or symptomatic depression and no serious chronic medical conditions,[20] 534 outpatients aged 60 to 86 with major depression,[14] 43 depressed MOS patients with serious chronic medical conditions, and 56 MOS patients with symptomatic depression and no serious chronic medical conditions[20] (means of 52.8, 54.5 (calculated from data included in [14]), 56.9, and 65.2, respectively).[14,20] Finally, in the present study, the patients without major depression had a mean MHI-5 score of 71.7, which was lower than the means of 77.6 for 144 MOS patients with serious chronic medical conditions only and 82.5 for 576 MOS patients with minor medical conditions only.[20]

The main measure of criterion validity, the AUC, using as its criterion major depression as indicated by the MINI-MDE, was satisfactory for the entire sample (0.84) and for each of the subsamples, including the one with the lowest AUC (0.82). The optimal MHI-5 cutpoint for the entire sample (59/60) resulted in low but adequate sensitivity (78.7%) and specificity (72.1%) for major depression. Of greater concern was the low specificity (<70%) found when using the 59/60 cutpoint for proxy-reported cognitively impaired patients (lowest at 65.7%) and patients dependent in four to six ADLs.

Significant correlation between the MHI-5 and the presence of major depression as identified using the MINI-MDE demonstrated construct validity. This extends an earlier finding[14] of MHI-5 construct validity through significant associations with several depression measures. The mean age of the previous study's population was 67, few patients were aged 85 and older, and patients with substantial cognitive impairment or serious or unstable comorbid medical conditions had been screened out.[21] The mean age of patients in the current study was 80, one-third were aged 85 and older, 16.0% had moderate to very severe cognitive impairment as measured using the CPS, and the average patient had 4.5 chronic conditions. Heart disease, stroke, diabetes mellitus, and chronic obstructive pulmonary disease, all of which can be considered to be serious or unstable, were prevalent.

In the present study, a high correlation between the MHI-5 and the SF-36 role emotional scale (convergent construct validity) and a low correlation between the MHI-5 and the physical functioning scale (divergent construct validity) also indicated construct validity. In the MOS, the highest correlations with the MHI-5 were with social functioning and health perceptions, and the lowest was with physical functioning.[30] In the current study, with only a few exceptions, construct validity did not differ appreciably across the entire sample and the eight subsamples.

The finding that patients with lower MHI-5 scores had less education, fewer friends they felt close to, and fewer close relatives further demonstrated construct validity for the entire sample, although there was little evidence of construct validity for the eight subsamples when these same variables were examined, probably because of small sample size.

In conclusion, it was possible to detect appreciable criterion and construct validity for the entire study sample and across subsamples. Thus, it was possible to conclude that the MHI-5 is a valid measure of depression for functionally impaired, community-dwelling elderly Medicare patients as well as for subsamples of this population defined in terms of cognitive functioning and ADL dependence. Researchers and clinicians should pay special attention to the MHI-5 cutpoint indicating depression in cognitively impaired patients because it appears to be considerably lower (47/48) for patients with cognitive impairment who answer the MHI-5 themselves and slightly higher (63/64) for the patients for whom a proxy respondent provides the answers.

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Author Contributions: Dr. Friedman conceptualized the study and was responsible for and participated in all of its aspects, including study concept and design, acquisition of data, analysis and interpretation of data, and preparation of the manuscript. Dr. Heisel participated in determining which psychometric analyses to use, data analysis, interpretation of the analyses, and preparation of the manuscript. Ms. Delavan performed the data analysis under the direction of Dr. Friedman and Dr. Heisel.

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