The Reliability and Validity of a Ten-Item Measure of Functional Status

Robert L. Blake, Jr., MD, and Trish A. Vandiver, MS
Columbia, Missouri

The accurate assessment of functional status is an important clinical activity in family practice. Many of the measures of function developed for research purposes, however, have questionable applicability to primary care practices. The Duke-UNC Health Profile (DUHP) is a 63-item instrument that assesses four dimensions of function: symptom experiences, physical function, social function, and emotional function. The reliability and validity of a ten-item subset (the mini-DUHP) of the DUHP was examined for 71 white adults with a profile of high stressful life changes and weak social supports. These subjects completed the DUHP on two occasions and provided personal morbidity data by monthly mailed questionnaire for an intervening six-month period.

On both administrations of the instrument, mini-DUHP scores were strongly correlated with composite DUHP scores (r = .81 and .84) and moderately correlated with each of the four functional dimension scores. The mini-DUHP demonstrated good temporal stability (r = .58). Mini-DUHP scores, determined both before and after the six-month period, were correlated with cumulative self-reported hospital days, bed disability days, restricted activity days, and physician utilization. Responses to the mini-DUHP strongly predicted bed disability, restricted activity, and physician visits after controlling for the effects of sociodemographic characteristics by multivariate analysis. This ten-item scale may be useful and practical in the assessment and monitoring of function in a primary care setting.

In family practice considerable clinical attention is directed to assessing and monitoring the functional capabilities of patients. This task has created the need for methods of measuring function that are reliable, valid, and practical for primary care. Numerous research instruments designed to assess function are available,[1-6] but their usefulness in primary care is questionable. The Duke-UNC Health Profile (DUHP) was developed specifically for use in the primary care setting.[7] This 63-item instrument asesses four dimensions of functional status: symptom experiences, physical function, social function, and emotional function. When tested on 395 ambulatory adults in a family practice center, the DUHP had acceptable reliability and validity and appeared to distinguish between relatively subtle but potentially important variations in function.[7]

The DUHP has been used as a measure of health status in a randomized controlled evaluation of a psychosocial intervention conducted in a group of white adults with a high level of stressful life changes and weak social-support resources.[8] In this study the DUHP produced functional status scores that were relatively stable over 15 months, were concordant with two single-item measures of health status, and were correlated with self-reported six-month morbidity.[9] While the DUHP appears to have value as a primary care research tool, the length may impair its use to assess and monitor function in a busy practice setting. Recognizing this limitation, the developers of the instrument have identified by item analysis a ten-item subset of the DUHP (the mini-DUHP) that may have more practical clinical applicability. This paper reports an appraisal of the reliability and validity of the ten-item mini-DUHP.

Submitted, revised, May 20, 1986.

From the Department of Family and Community Medicine, University of Missouri–Columbia, Columbia, Missouri. Requests for reprints should be addressed to Dr. Robert L. Blake, Jr., M222 Health Sciences Building, Department of Family and Community Medicine, University of Missouri–Columbia, Columbia, MO 65212.

TABLE 1. SOCIODEMOGRAPHIC CHARACTERISTICS

Characteristic	Percentage
Sex	
Female	77.5
Male	22.5
Age (years)	
21-29	38
30-39	32.5
40-49	14
50-59	15.5
Marital status	
Married	63
Never married	16
Separated or divorced	21
Education	
High school or less	22
Vocational or some college	16
Completed college	62
Annual income	
< $20,000	51
$20,000-$30,000	23
> $30,000	26
Employment status	
Employed full time	56.5
Employed part time	14.5
Not employed	29

METHODS

Data for this analysis were obtained from 71 white adults aged 21 to 59 years who served as controls in a clinical trial testing the efficacy of a stress-management program.[8] These subjects were registrants of three family practice clinics operated by the University of Missouri-Columbia who qualified for the study by attaining a 12-month score of greater than 175 on the Social Readjustment Rating Scale[10] and scoring low on a social-support index.[11] They completed and returned a mailed DUHP questionnaire in June 1983 and again in March 1984. In addition, starting in September 1983 they reported by mail each month their morbidity and their utilization of medical services. The sociodemographic profile of these 71 subjects is presented on Table 1.

Responses to the DUHP were scored as previously described.[7] A three-point ordinal scale, ranging from low function through intermediate function to high function, was provided for each of the 26 symptom items, each of the 9 physical function items, and each of the 5 social function items. A five-option rsponse scale accompanied each of the 23 items of the emotional status dimension. A numerical value was assigned to each item response. The values ranged from 0 (poor function) to 2 (good function) for three-point scales and from 0 to 4 for five-point scales. A separate score was calculated for each dimension of function by dividing the sum of individual item values by the maximum possible score for the dimension. The resulting functional dimension scores were expressed as a proportion ranging from 0.00 for the worst possible status to 1.00 for the best possible status.

In the current study the logic and method of scoring developed by the originators of the DUHP were extended to derive a multidimensional composite score that reflects overall functional status. This summary score was computed for each subject and expressed as a proportion. The composite score consisted of the sum of all item response values divided by the maximum possible value of all items answered. For example, a composite score of 0.7 indicates a functional level that is 70 percent of the maximal level. This score is not a mean of dimensional scores; it is more heavily weighted by the dimensions (symptoms and emotional) that have the most items.

The ten items of the mini-DUHP are shown in Figure 1. It is important to recognize that in this study these ten items were not administered as a separate unit but were contained within the 63-item instrument. These items were selected for inclusion in the subscale because of their high correlation with their respective functional dimension scores (G. Parkerson, MD, personal communication, 1985). The mini-DUHP is conceptualized as measuring a single construct of health status and does not retain the four dimensions included in the DUHP.

A mini-DUHP score was calculated as described for the composite score and was expressed as a proportion. A higher score denoted better overall function. The reliability of the mini-DUHP was assessed by two approaches. First, the extent to which the mini-DUHP score approximated dimension scores and the composite score was examined with Spearman correlation coefficients. Second, stability of mini-DUHP scores over time was determined by comparing scores from June 1983 with scores from March 1984. Concurrent validity of the mini-DUHP was tested by separately exploring the correlations of the June 1983 and the March 1984 scores with cumulative self-reported morbidity from September 1983 through February 1984. Spearman coefficients were used to assess these correlations.

Monthly morbidity was measured by a mailed questionnaire adapted from the National Health Survey instrument.[12] Distributed at the beginning of each month, the questionnaire collected the following information about the preceding month: the number of days of hospitalization, the number of days spent in bed at home, the number of days of missed work or school, the number of days of reduced activity because of health problems, and the number of physician visits. For the analysis, morbidity was aggregated over the six months of September 1983 through February 1984. Morbidity variables consisted of hospital days, bed disability days (hospital days plus other bed days), restricted activity days (bed disability days plus days of missed work or school plus days of reduced activity), and physician visits.

During the past week how much trouble have you had with:

	None	Some	A Lot
1. Sleeping?	___	___	___
2. Getting tired easily?	___	___	___
3. Weakness in any part of your body?	___	___	___

Today would you have any physical trouble or difficulty:

4. Walking up a flight of stairs?	___	___	___
5. Running the length of a football field?	___	___	___

During the past week how often did you:

	Not at All	1-4 Days	5-7 Days
6. Get your work done as carefully and accurately as usual?	___	___	___
7. Take part in social, religious, or recreational activities (meetings, church, movies, sports, parties)?	___	___	___

How well does each statement describe you:	Yes, Describes Me Exactly	Somewhat Describes Me	No, Doesn't Describe Me At All
8. I like who I am.	___	___	___
9. I'm a failure at everything I try to do.	___	___	___
10. I am comfortable being around people	___	___	___

Figure 1. The Mini-Duke–UNC Health Profile

To control for potential confounding of the relationship between the mini-DUHP score and morbidity by sociodemographic characteristics, multiple linear regression was performed using the Statistical Package for Social Sciences. Six-month hopsital days, bed disability days, restricted activity days, and physician visits were analyzed separately as dependent variables. The following independent variables were entered into each model in a stepwise fashion: age (1 = 21 to 29 years, 2 = 30 to 39 years, 3 = 40 to 49 years, 4 = 50 to 59 years), gender, marital status (1 = married, 2 = not married), socioeconomic status (1 = less than college education and less than $20,000 annual income, 2 = less than college education or annual income less than $20,000, 3 = college education and annual income over $20,000), employment status (1 = not employed, 2 = employed part time, 3 = employed full time), and the June 1983 mini-DUHP score. The unconfounded effect of the mini-DUHP measure on each morbidity variable was determined by examining β values obtained after the five other independent variables had entered the regression models.

RESULTS

The 71 control subjects included in this analysis completed DUHP questionnaires in June 1983 and March 1984 and provided morbidity data for each of the six months. The range of mini-DUHP scores was .12 to .85 at both June 1983 and March 1984 with mean scores of .66 and .62, respectively.

Examining the reliability of the mini-DUHP, correlation coefficients relating mini-DUHP scores to dimension scores and composite scores for June 1983 and March 1984 were compared (Table 2). The mini-DUHP score was moderately associated with each dimension score and strongly correlated with the composite score at each administration of the DUHP. The coefficient for the correlation of the June 1983 and March 1984 mini-DUHP scores was .58 ($P < .001$), which was comparable to the correlation coefficients for dimension scores and the composite functional status scores shown in Table 3.

Means (standard deviations in parentheses) for six-month morbidity days and physician visits were 0.60 (1.98) hospital days per person, 6.24 (17.28) bed disability days per person, 20.82 (29.22) restricted activity days per person, and 3.93 (3.84) physician visits per person.

The correlations of the June 1983 functional dimension scores, the composite score, and the mini-DUHP score with each morbidity variable are provided in Table 4. The negative sign indicates correlation in the expected direction; lower scores were associated with higher morbidity. In general, the mini-DUHP score had stronger and more consistent associations with morbidity than the dimension scores. The magnitude

TABLE 2. SPEARMAN COEFFICIENTS FOR CORRELATION OF MINI-DUHP SCORES WITH DIMENSION SCORES AND COMPOSITE SCORES

	June 1983	March 1984
Symptom score	.66	.59
Physical function score	.48	.48
Social function score	.54	.62
Emotional function score	.68	.58
Composite score	.81	.84

$P < .001$ for all coefficients

TABLE 3. SPEARMAN CORRELATION COEFFICIENTS: JUNE 1983 WITH MARCH 1984 SCORES

	Coefficient	P Value
Mini-DUHP	.58	< .001
Symptom score	.62	< .001
Physical function score	.54	< .001
Social function score	.36	< .01
Emotional function score	.79	< .001

TABLE 4. SPEARMAN COEFFICIENTS FOR CORRELATIONS OF JUNE 1983 DUHP SCORES WITH SIX-MONTH MORBIDITY

Function	Hospital Days	Bed Disability Days	Restricted Activity Days	Physician Visits
Symptoms	−.21	−.47***	−.34**	−.32**
Physical	−.27*	−.19	−.07	−.28*
Social	−.23*	−.21	−.25*	−.20
Emotional	−.06	−.37**	−.24*	−.30*
Composite	−.25*	−.43***	−.32**	−.40***
Mini-DUHP	−.29*	−.38***	−.39***	−.34**

*$P < .05$
**$P < .01$
***$P < .001$

of correlations of the mini-DUHP score with morbidity was generally comparable to that of the composite score, suggesting that the ten-item subscale was an accurate proxy of the 63-item instrument. Similar findings were obtained when the March 1984 scores were correlated with cumulative six-month morbidity (data not shown).

The results of the multivariate analysis to control for the effects of sociodemographic characteristics on the association of the June 1983 mini-DUHP score with morbidity measures are shown on Table 5. The June 1983 score was highly predictive of bed disability, restricted activity days, and physician visits independent of age, gender, marital status, socioeconomic status, and employment. The correlation with hospital days was weak and did not attain a conventional level of statistical significance. The R^2 values for the regression models indicated that the variance explained ranged from 16 percent for hospital days to 50 percent for bed disability days.

TABLE 5. RESULTS OF MULTIPLE LINEAR REGRESSION: β VALUES REFLECTING CORRELATION OF JUNE 1983 MINI-DUHP WITH MORBIDITY VARIABLES CONTROLLING FOR FIVE SOCIODEMOGRAPHIC CHARACTERISTICS

Variable	β	F Value	P
Hospital days	−.232	3.15	< .1
Bed disability days	−.638	39.60	< .001
Restricted activity days	−.614	33.47	< .001
Physician visits	−.555	21.48	< .001

DISCUSSION

The mini-DUHP was found to have acceptable reliability in this sample of white, predominantly female adults with a high-risk psychosocial profile. The nine-month stability of mini-DUHP scores was comparable to that of dimension scores and the composite functional status score. As some variation in health status over time is to be expected, the level of temporal stability demonstrated is impressive. The results displayed in Table 2 indicate that the mini-DUHP encompasses each of the four dimensions of function. The magnitude of the correlation coefficients provides independent support for the item analysis that originally generated this subscale of the DUHP. The Spearman coefficients of .81 and .84 that quantitate the correlations of mini-DUHP scores with composite

scores indicate that the shorter scale substantially approximates the 63-item measure.

Concurrent validity of the mini-DUHP is suggested by the findings shown in Table 4 and Table 5. Mini-DUHP scores based on measurements both before and after the six-month target period correlated with self-reported morbidity and physician utilization. As a predictor of subsequent morbidity, the mini-DUHP performed as well as the composite measure and better than the individual dimensions of function. These findings indicate that the combination of symptom status and physical, social, and emotional function is more strongly related to health status and morbidity than any of the components of function alone. The mini-DUHP score and the summary DUHP score appear to have essentially equivalent value in reflecting health status.

Because of its ability to assess the four dimensions of function with greater precision and specificity, the full 63-item measure may be superior to the mini-DUHP for research purposes. Because of its brevity, reliability, and validity, however, the mini-DUHP may well be preferable for practical clinical use.

The results of the multivariate analysis indicate that the strong associations of the June 1983 mini-DUHP score with two morbidity measures and physician utilization are not secondary to confounding by sociodemographic variables. The weak correlation of mini-DUHP score and other DUHP scores with hospital days is probably related to several factors. Only 10 percent of the subjects were hospitalized during the six-month period; thus the variability of this outcome was constrained. This restricted variability may to some extent account for the low correlations. In addition, labor and delivery constituted the most common reason for hospitalization; for many women pregnancy may not significantly alter function as assessed by the mini-DUHP.

The dependence of the DUHP scores and the morbidity variables on subject self-report constitutes a limitation of this study. A propensity of certain subjects consistently to underreport their functional capacity and to exaggerate their morbidity could produce a spurious association. While this possible bias cannot be completely excluded, it is unlikely to account for the significant correlations found. The measure of morbidity employed in this study has been extensively validated. In addition, medical records of subjects in the clinical trial were reviewed to verify reported morbidity information. Approximately 85 percent of physician visits and 100 percent of hospitalizations documented in the medical records were reported by study controls on monthly questionnaires.

As is true of virtually all clinical trials, these subjects were not randomly selected from some larger population. They were family practice patients with high psychosocial risk who were willing to participate in a study. The extent to which these volunteers are representative of other family practice populations is uncertain. Patients with high psychosocial risk may be considered by their physicians as candidates for counseling, education, or some other form of behavioral intervention designed to reduce morbidity. These findings suggest that the mini-DUHP may be useful in monitoring the effect of such interventions on functional status. Final judgment regarding the value of this scale awaits further testing on populations with different sociodemographic characteristics. In addition, further assessment of the clinical utility of the mini-DUHP will require administration of the ten-item scale separate from the 63-item instrument.

References

1. Fanschel S, Bush JW: A health-status index and its application to health-services outcomes. Operations Res 1970; 18:1021-1028
2. Sackett DL, Chambers LW, MacPherson AS, et al: The development and application of indices of health: General methods and a summary of results. Am J Public Health 1977; 67:423-428
3. Stewart AL, Ware JE, Brook RH: Advances in the measurement of functional status: Construction of aggregate indexes. Med Care 1981; 19:473-486
4. Bergner M, Bobbitt RA, Carter WB, et al: The Sickness Impact Profile: Development and final revision of a health status measure. Med Care 1981; 19:787-805
5. Cairl RE, Pheiffer E, Keller DM, et al: An evaluation of the reliability and validity of the Functional Assessment Inventory. J Am Geriatr Soc 1983; 31:607-612
6. Brown JH, Kazis LE, Spitz RW, et al: The dimensions of health outcomes: A cross-validation examination of health status measurement. Am J Public Health 1984; 74:159-161
7. Parkerson GR, Gehlbach SH, Wagner EH, et al: The Duke-UNC Health Profile: An adult health status instrument for primary care. Med Care 1981; 19:806-823
8. Blake RL: Short term health effects of a psychosocial intervention. Presented at the 14th Annual Meeting of the North American Primary Care Research Group, Seattle, Wash, April 15, 1985
9. Blake RL, Vandiver TA, Zweig SC, et al: Evaluation of a health status measure in adults with high psychosocial risk. Fam Pract Res J 1986; 5:158-166
10. Holmes TH, Rahe RH: The social readjustment rating scale. J Psychosom Res 1967; 11:213-218
11. McKay D, Blake RL, Colwill JM, et al: Social supports and stress as predictors of illness. J Fam Pract 1985; 20:575-581
12. Disability Days United States 1975, Data from the National Health Survey. In National Center for Health Statistics (Hyattsville, Md): Vital and Health Statistics, series 10, No. 118. DHEW publication No. (PHS) 78-1546. Government Printing Office, 1978