Development of the 17-Item Duke Health Profile

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The 17-item Duke Health Profile (DUKE) was developed as a refined version of the 63-item Duke-UNC Health Profile (DUHP) using a methodology based upon a balanced clinical and statistical rationale. The result is a brief, valid functional health measure with 10 scales that compares well with the MOS Short-form and the COOP Charts. In addition to the five constructs (ambulation, emotional symptoms, activities with friends or relatives, health perception, and pain) which are measured by all three of the instruments, the DUKE quantitates cognition, social self-esteem, confinement, and somatic symptoms other than pain.

Measurement of health outcomes is recognized as important in modern medicine.[1-3] In order to be useful in primary care settings, instruments for measuring health must be very brief, user-friendly, and beneficial to patients and health care providers. The COOP Charts (COOP),[4] The MOS Short-form (MOS-20),[5] and the Duke Health Profile (DUKE)[6] are examples of measures which may prove to meet these requirements.

OBJECTIVE

The present report describes the DUKE, how it was developed from the 63-item Duke-UNC Health Profile (DUHP),[7] and how it compares with the COOP and MOS-20.

METHODS

Secondary analyses were performed by Parkerson *et al.*[7-9] and Broadhead *et al.*[10] which used the DUHP on patients in the Duke-Watts Family Medicine Center in Durham, North Carolina, USA.

The DUHP is a self-report, generic 63-item functional health measure with four dimensions: symptom status, physical function, emotional function and social function. Because it is somewhat lengthy for primary care use, and because of several conceptual problems, such as using self-esteem as the sole indicator of emotional function, it was revised into the 17-item DUKE.[6]

The revision process included categorization of all 63 DUHP items according to their clinical face validity

for physical, mental, or social health function, and then item reduction by use of item-remainder analyses. Items were retained if their Spearman rank-order correlations with the remaining items in their respective subscales (i.e., the item-remainder correlations) were high, and if they were clinically important and reasonably independent of each other. After the new smaller set of items was selected, item-remainder correlations with the new scale and item-to-scale correlations with other scales were computed to demonstrate item discriminant validity, as indicated when an item's correlation with the remaining items of its own scale exceeded that same item's correlation with another scale.

Comparisons were made between the DUHP and the DUKE with regard to their construct validity when correlated with scores of the Sickness Impact Profile (SIP),[11] the Duke Social Support and Stress Scale (DUSOCS),[8] the Family Strengths measure,[12] and the Family Inventory of Life Events scale (FILE).[13] The SIP quantitates physical and psychosocial function. The DUSOCS measures family and non-family support and stress; Family Strengths assesses family social support; and the FILE, family stress.

Changes in scores of the DUKE and DUHP were compared over a 2.5 month period of time during an intervention study which used functional health as the outcome.[9] For these comparisons, effect sizes were calculated and used to measure sensitivity of change in health status as advocated by Kazis *et al.*[14]

The DUKE was compared with the COOP and the MOS-20 with regard to type and number of items for each of a series of health constructs. The COOP measures nine components of functional health and quality of life using a pictorial chart and one item for

each component.[4] The MOS-20 measures function in six components.[5]

RESULTS

The family practice study population used to validate the DUKE consisted of 683 ambulatory adults with a mean age of 34.1±12.7 SD years, who were mostly female, white, married, living with their families, and working full-time.[6] Their most common diseases were hypertension, acute upper respiratory infection, obesity, and depression; their most common health problems other than diseases were medical examination, prenatal care, and oral contraception.[6]

Item selection for the DUKE physical health scale is illustrated in Table 1. Of the 28 DUHP items which relate clinically to physical function, eight items had the highest item-remainder correlations (0.40–0.52).

TABLE 1 *Item selection for the physical health scale of the Duke Health Profile (DUKE) from the Duke-UNC Health Profile (DUHP) using health scores from 683 ambulatory adult patients.*

r*	DUHP item	r**	DUKE item
	Eyesight		
	Hearing		
	Talking		
	Tasting food		
0.41	Appetite		
	Chewing food		
	Swallowing		
	Breathing		
0.46	Sleeping	0.37	Sleeping
	Moving bowels		
	Urinating		
	Headache		
0.44	Hurting or aching	0.40	Hurting or aching
	Itching		
	Indigestion		
	Fever		
0.51	Getting tired	0.40	Getting tired
	Fainting		
0.42	Weakness		
	Weight loss		
	Weight gain		
	Bleeding		
	Having sex		
	Walking to bathroom		
0.40	Walking up stairs	0.43	Walking up stairs
0.52	Running football field	0.45	Running football field
0.46	Running mile		
	Running 5 miles		

*Item-remainder Spearman rank-order correlations between the item and other DUHP items which relate to physical function. Only those correlations higher than 0.30 are shown in this table ($P \leqslant 0.0001$).

**Item-remainder Spearman rank-order correlations between the item and other items selected for the DUKE physical health scale ($P \leqslant 0.0001$).

From these the five items asking about sleep, hurting or aching (pain), getting tired (fatigue), walking, and running were selected for the DUKE physical health scale. This final stage of selection was based partly on clinical content, because selection of the five items with very highest correlations would have resulted in a scale with two running items and no walking item. The five items selected represent a balance between selection based upon clinical and statistical rationale. Using this same balanced approach, five DUHP items were selected for the DUKE mental health scale and five for social health.

Items discriminant validity is shown in Table 2 for DUKE physical health. All of the correlations were higher between the physical item scores and the scores of the combined remaining items in the physical scale (item-remainder correlations) than between the physical item scores and the mental and social scale scores (item-to-scale correlations). This difference was pronounced for all items except the fatigue item, indicating excellent discriminant validity for four of the five. The fatigue item did not discriminate well between physical and mental health, as shown by the correlations of 0.40 and 0.38, respectively, which were almost equal. However, the fatigue item did distinguish between physical and social health, with its correlations of 0.40 with physical and 0.20 with social health.

TABLE 2 *Item discriminant validity for the Duke Health Profile (DUKE) physical health scale, using health scores from 683 ambulatory adult patients.*

Item	Scale		
	Physical health[a]	Mental health[b]	Social health[b]
Sleeping	0.37	0.28	0.22
Hurting or aching	0.40	0.18	0.19
Getting tired	0.40	0.38	0.20
Walking up stairs	0.43	0.17	0.12
Running football field	0.45	0.19	0.20

[a] Item-remainder Spearman rank-order correlations. $P \leqslant 0.0001$.
[b] Item-to-scale Spearman rank-order correlations. $P \leqslant 0.0001$ except for the one correlation, 0.12, where $P \leqslant 0.01$.

As reported in the original validation study, the result of the complete item selection process was the 17-item DUKE (Figure 1) with 10 scales, whose internal consistency reliability α-coefficients ranged between 0.55 and 0.78.[6] These scales and their conceptual constructs are shown in Table 3. As an example, the five items for physical health represent the two constructs: somatic symptoms (sleeping, hurting or aching, and getting tired) and ambulation (walking and running).

Comparative convergent and discriminant scale validity between the DUHP and the DUKE, as their

Date Today:_____   Date of Birth:_____   ID Number:_____

DUKE HEALTH PROFILE (The DUKE)

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INSTRUCTIONS:

Here are a number of questions about your health and feelings. Please read each question carefully and check (√) your best answer. You should answer the questions in your own way. There are no right or wrong answers. (Please ignore the small scoring numbers next to each blank.)

	Yes, describes me exactly	Somewhat describes me	No, doesn't describe me at all
1. I like who I am	12	11	10
2. I am not an easy person to get along with	20	21	22
3. I am basically a healthy person	32	31	30
4. I give up too easily	40	41	42
5. I have difficulty concentrating	50	51	52
6. I am happy with my family relationships	62	61	60
7. I am comfortable being around people	72	71	70

TODAY would you have any physical trouble or difficulty:

	None	Some	A Lot
8. Walking up a flight of stairs	82	81	80
9. Running the length of a football field	92	91	90

DURING THE PAST WEEK: How much trouble have you had with:

	None	Some	A Lot
10. Sleeping	102	101	100
11. Hurting or aching in any part of your body . .	112	111	110
12. Getting tired easily	122	121	120
13. Feeling depressed or sad	132	131	130
14. Nervousness	142	141	140

DURING THE PAST WEEK: How often did you:

	None	Some	A Lot
15. Socialize with other people (talk or visit with friends or relatives)	150	151	152
16. Take part in social, religious, or recreation activities (meetings, church, movies, sports, parties)	160	161	162

DURING THE PAST WEEK: How often did you:

	None	1-4 Days	5-7 Days
17. Stay in your home, a nursing home, or hospital because of sickness, injury, or other health problem	172	171	170

FIGURE 1.

TABLE 3 *Conceptual constructs for the Duke Health Profile (DUKE) scales.*

Scales	Constructs
Physical Health	Somatic symptoms including pain, ambulation
Mental Health	Emotional symptoms, personal self-esteem, cognition
Social Health	Social self-esteem, social activities
General Health	Physical health, mental health, social health
Perceived Health	Health perception
Self-esteem	Personal self-esteem, social self-esteem
Anxiety	Somatic symptoms other than pain, emotional symptoms, cognition, social self-esteem
Depression	Somatic symptoms other than pain, emotional symptoms, cognition, personal self-esteem
Pain	Hurting or aching
Disability	Confinement to home

scores relate to scores of the SIP are shown in Table 4 for a group of 103 ambulatory adult patients in the Duke-Watts family practice.[6,7] The correlations of both the DUHP and DUKE physical scores with SIP physical scores were higher than their correlations with SIP emotional or social scores. Most of the DUKE correlations were higher than those of the respective DUHP correlations with comparable SIP scales. This was most evident for the social scales, where the

TABLE 4 *Comparison of the convergent and discriminant validity of the Duke-UNC Health Profile (DUHP) and the Duke Health Profile (DUKE) as related to the Sickness Impact Profile (SIP) (n = 103 ambulatory adult patients)*

DUHP and DUKE	SIP[a]		
	Physical	Emotional behaviour	Social interaction
Physical			
DUHP	[-0.51]****	-0.36***	-0.42****
DUKE	[-0.63]****	-0.51****	-0.54****
Mental			
DUHP	-0.18	[-0.45]****	-0.50****
DUKE	-0.15	[-0.48]****	-0.46****
Social			
DUHP	-0.12	-0.14	[-0.24]*
DUKE	-0.14	-0.30**	[-0.41]****

[a] All values in the table are Spearman rank-order correlations. Values in brackets are those which are expected on the basis of scale content to be higher than corresponding values in their respective rows (see references 6 and 7 for original reports.)
*P ≤ 0.05 **P ≤ 0.01 ***P ≤ 0.001 ****P ≤ 0.0001.

DUKE correlation with SIP social interaction was -0.41 compared with -0.24 for the DUHP. This indicates that the revised DUKE social scale has higher convergent validity than the original DUHP social scale, when the SIP is used as a criterion instrument.

Further comparison of the DUHP and DUKE social scales was done by secondary analysis of data from a different set of 246 patients in the Duke-Watts practice.[8] Of this group 33 percent were 18-29 years of age; 50 percent, 30-39 years; and 17 percent, 40-49 years.[8] As shown in Table 5, the correlations of the DUKE social health scores were much higher than those of the DUHP social function scores with social support and stress scores from the DUSOCS, Family Strengths, and FILE.

TABLE 5. *Comparison of the social health scales of the Duke Health Profile (DUKE) and the DUKE-UNC Health Profile (DUHP) when correlated with measures of social support and stress (n = 246 ambulatory adult patients).*

Social support and stress measures	Social Health Scales[a]	
	DUKE	DUHP
Social support		
DUSOCS[b] family support	+0.31**	+0.07
Family strengths	+0.43**	+0.17*
Social stress		
DUSOCS[b] family stress	-0.32**	-0.09
FILE[c] family stress	-0.22**	-0.15*

[a] Spearman rank-order correlation coefficients P ≤ 0.0001 if correlation ≥ | 0.24 | , P ≤ 0.05 if correlation ≥ | 0.14 | .
[b] DUSOCS = Duke Social Support and Stress Scale.
[c] FILE = Family Inventory of Life Events, subscales I and II.
*P ≤ 0.05 **P ≤ 0.0001.

Comparison of the 5-item DUKE self-esteem scale with the 23-item DUHP emotional function scale, which also measures self-esteem, demonstrated a greater combined effect size for change in DUKE scores than for change in DUHP scores over time in a randomized trial using a family assessment intervention.[9] As shown in Table 6, the effect size when measured by the DUKE (+1.32) was much greater than the effect size when measured by the DUHP (+0.77). An effect size of ≥ 0.80 is considered to be a large effect by Cohen.[15] In this instance the 5-item DUKE scale appeared to be more robust than the DUHP scale which contained more than four times the number of items. The original data for these effect size analyses came from a third study population in the Duke-Watts practice, in which half of the patients were aged 18-33 years, half 34-49 years, and in which half were women.[9]

The constructs of the DUKE, MOS-20, and COOP are compared in Table 7. The number of DUKE items per construct varies from zero to two, except for the 15 items which measure DUKE general health. The MOS

TABLE 6.   *Comparison of the 5-item self-esteem subscale of the Duke Health Profile (DUKE) with the 23-item emotional function subscale of the Duke-UNC Health Profile (DUHP) in Black patients during a 2.5 month clinical trial.*[9]

| Patient group and instrument | No. Items | Mean health scores[a] | | | P value | Effect size[b] | Combined effect size[c] |
		No. Patients	Time 1	Change T_2-T_1			
Control							
DUKE	5	20	79.3 ± 12.6	−7.8	0.04	−0.62	
DUHP	23	20	77.0 ± 13.2	−3.0	0.19	−0.23	
Intervention							
DUKE	5	21	73.8 ± 16.3	+ 8.8	0.009	+ 0.54	+ 1.32
DUHP	23	23	75.8 ± 13.1	+ 7.2	0.002	+ 0.55	+ 0.77

[a] Mean ± standard deviation (scale 0–100). High scores = good health.
[b] Effect size = change in mean health score from Time 1 to Time 2, divided by the standard deviation of the mean health score at Time 1.
[c] Combined effect size = difference in the change of intervention and control mean health scores from Time 1 to Time 2, divided by the standard deviation of the mean health score of the control group at Time 1.

has one to four items per construct, and all COOP constructs, including overall health, are measured by only one item. Five constructs are common to all three instruments, namely: ambulation, emotional symptoms, activities with friends or relatives, health perception, and pain. The COOP includes three items (change in health, overall quality of life, and social support) which are neither in the DUKE nor the MOS-20. The MOS-20 includes two items (self care and illness perception) not contained in the other two instruments. The DUKE has four unique constructs (cognition, social self-esteem, confinement, and somatic symptoms other than pain).

DISCUSSION

The process of reconceptualizing, revising, shortening, refining, and revalidating existing functional health status measures, as illustrated by the present study, is very important in the evolution of health measurement. This is especially true for instruments which are proposed for use in the primary care setting, where volume is high, physical and psychosocial issues are complex and inseparable, and continuity of care and long-term outcomes are equally as important as episodic care and short-term outcomes. Those questionnaire items which are shown repeatedly to be effective need to be culled from the larger pack of items which are less powerful. Practising health care providers and their coworkers have no time for unnecessary exercises. Also, since most providers have little time or resources for developing questionnaires, it is incumbent upon the researchers to produce what is really useful for the clinicians and their patients.

The 17-item DUKE is an example of one attempt to respond to clinicians' needs. When compared with the 63-item DUHP parent instrument, the DUKE appears to be a significant improvement. It is much shorter and easier to self-administer, its scales have improved

validity, and it furnishes a wide variety of scales which are relevant to clinical practice. If these scales, such as the 5-item depression scale, continue to stand up as valid in future studies, the DUKE may prove to be not only an outcome measure, but also an effective first-order screening tool for occult health problems.

When the DUKE is compared with the MOS-20 and the COOP, it is seen that all three instruments, although developed by different groups of investigators, include five very basic health constructs: ambulation, emotional symptoms, activities with friends or relatives, health perception, and pain. In addition, the MOS-20 includes self care, which had been included on the DUHP but was omitted from the revised DUKE because of the infrequent occurrence of problems with self care in ambulatory primary care patients.

Change in health, which is one of the COOP constructs, was not included in the DUHP and DUKE because the purpose of those two instruments is to measure health at a 'slice in time'. Change in health can be determined by comparing health scores which are measured at two or more different times. Also, social support was not included in the DUHP and DUKE because social support was considered to be primarily a determinant of functional health, rather than a health outcome.

While brevity is important for functional health measures, every attempt should be made to collect as much essential information as possible. A major strength of the DUKE is that it includes items for cognition, social self-esteem, confinement, and somatic symptoms other than pain, which are not included in either the MOS-20 or the COOP Charts. Since seven of the 17 DUKE items pertain to these additional constructs, the instrument would be shorter but much less informative without them. Although further study is needed to determine how useful this additional information is to clinicians, the developers of the DUKE

believe that the modest increment in length is justified by the value of the information.

TABLE 7. *Construct comparison of the Duke Health Profile (DUKE), the MOS Short-form (MOS-20), and the COOP Charts.*

Construct	Number of items[a]		
	DUKE	MOS-20	COOP
Physical			
Ambulation	2	4	1
Somatic symptoms, other than pain	[2][b]	0	0
Upper extremities	0	3	1
Self care	0	[1]	0
Mental			
Emotional symptoms	2	4	1
Personal self-esteem	2	1	0
Cognition	[1]	0	0
Social			
Activities with friends or relatives	1	1	1
Activities with groups	1	0	1
Social self-esteem	[3]	0	0
General Health	15	0	1
Change in Health	0	0	[1]
Perceptions			
Health perception	1	3	1
Illness perception	0	[2]	0
Disability or Role Impairment			
Confinement	[1]	0	0
Inability to work	0	2	1
Pain	1	1	1
Quality of Life			
Overall	0	0	[1]
Social Support	0	0	[1]

[a] Items are counted more than once if they address more than one construct.
[b] Numbers in brackets indicate that the specified instrument is the only one which includes items for that respective construct.

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